PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE

by

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DECLARATION

I, **HERBERT ZIGARA** declare that this thesis entitled **"PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE"** is my own work and all sources that I have used, have been indicated and acknowledged by means of complete references.

Signature: **Date: 24 – 03 - 2020**

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DEDICATION

This thesis is dedicated to my wife Rugare Zigara and my children Viola, Blessings, Grateful and Gracious for their encouragement during my studies. They provided physical, emotional and prayerful support throughout the study.

ABSTRACT

The purpose of this study was to explore the nature of boys' and girls' access to and their performance in science and technology subjects at one mixed sex and one single sex school in Zimbabwe. The research was anchored on the mixed methods research design which combined quantitative and qualitative research designs in a single study. The study's quantitative objective was to establish if there was any significant difference in access to and performance in science and technology subjects between girls in a single sex school and their counterparts in a mixed sex school. A comparison of boys and girls learning together at a mixed sex school as well as boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of their access to and performance in science and technology subjects. The main objective that generated qualitative data sought to explore factors that could influence access to and performance of boys and girls in science and technology subjects at single sex and mixed sex schools. The case study comprised of two research sites; a mixed sex and a single sex school in Zimbabwe. The probability stratified random sampling technique was adopted for the quantitative sample size which comprised of 112 boys and girls from a mixed sex school and 81 girls from a single sex school. The qualitative sample size from the two study sites was purposively selected. The sample at a mixed sex school consisted of 1 head of school, 1 deputy head, 2 science and technology subjects HODs, 11 science and technology subjects class teachers and 8 science and technology subject teachers. The sample at a single sex school comprised of 1 head of school, 1 deputy head, 2 science and technology subject HODs, 10 science and technology subjects class teachers and 7 science and technology subject teachers. Quantitative data was collected using survey questionnaires administered to learners and document analysis. Qualitative data was gathered using Individual face-to-face semi-structured interviews with teachers. Quantitative data analysis was done statistically using chi-square and binomial tests while qualitative data were analysed thematically and in purely descriptive form. Quantitative findings revealed that there was significant difference ($p<0.05$) in terms of access to subjects at school which favoured single sex school girls compared to mixed sex school girls. On subjects offered, mixed sex school girls had more subjects taught at their school and therefore, had more access. With regards to access between boys and girls at a mixed sex school, statistical findings revealed significant difference ($p<0.05$) in favour of boys. In terms of subjects offered, both mixed sex school boys and girls had access to all subjects which were the focus of this study except building. Statistical findings on access between girls at a single sex school and boys at a mixed sex school indicated significant difference ($p<0.05$) in favour of single sex school girls. In terms of subjects offered, mixed sex school boys had more access as they are exposed to more science and technology related subjects than girls at a single sex school. With regards to performance between mixed sex school girls and those at a single sex school, statistical findings depicted significant difference ($p<0.05$) in favour of single sex school girls. Statistical findings on performance indicated no significant difference ($p>0.05$) between boys and girls learning together at the same school. Chi-square results revealed that single sex school girls performed better ($p<0.05$) than mixed sex school boys. Qualitative findings revealed that socialising agents namely, the media, home, school and peers promote a patriarchal ideology which favours boys than girls and help to track more boys than girls into science and technology subjects. On factors that influence school performance in science and technology subjects on gender lines; it emerged that patriarchal ideologies embedded in society create a notion of male superiority over females. The school, home, peers and the media portray boys as more powerful than girls, thereby enhancing their performance in science and technology subjects compared to girls. The study recommended family dialogues on gender roles, gender sensitive seminars in communities, government advocacy programmes, gender sensitive textbooks in communities and schools, gender sensitive modules to student teachers, deployment of gender experts in schools and crafting of policies to make the teaching of science and technology subjects mandatory. The study also recommended provision of national legislative platforms as well as dialogue and review of national, regional and international statutes on gender inequalities to redress the perception that boys are more capable than girls in science and technology subjects.

KEY WORDS: Science and technology subjects, mixed sex school, single sex school, patriarchy, socialisation,

LIST OF ACRONYMS

UN	:	United Nations
STEM	:	Science, Technology, Engineering and Mathematics
SARDC	:	Southern African Research and Documentation Centre
CEDAW	:	Convention on the Elimination of all forms of Discrimination Against Women
ACRWC	:	African Union Charter on the Rights and Welfare of the Child
SADC	:	Southern Africa Development Community
EFA	:	Education for All
MDGs	:	Millennium Development Goals
GoZ	:	Government of Zimbabwe
UNICEF	:	United Nations Children's Emergency Fund
UNESCO	:	United Nations Educational Scientific and Cultural Organisation
CRC	:	Convention on the Rights of the Child
EU	:	European Union
ICT	:	Information, Communication and Technology
STE	:	Science and Technology Education
SSA	:	Sub-Saharan African Countries
UDHR	:	Universal Declaration of Human Rights
ICCPR	:	International Convention on Civil and Political Rights
FLS	:	Forward Looking Strategies
BPFA	:	Beijing Declaration and Platform for Action
SDGs	:	Sustainable Development Goals
ACHPR	:	African Commission on Human and People's Rights
AU	:	African Union
RISDP	:	Revised Regional Indicative Strategic Development Plan
CEDE	:	Convention on the Elimination of Discrimination in Education
WCS	:	World Conference on Science
WSIS	:	World Summit on the information Science
CSW	:	Commission on the Status of Women

UNCSTD	:	United Nations Commission on Science and Technology for Development
GAB	:	Gender Advisory Board
PGP	:	Progressive Gender Policies
STCPA	:	Science and Technology Consolidated Plan of Action
CCPR	:	Convention on Civil and Political Rights
ZIMSEC	:	Zimbabwe Schools Examinations Council
ICESCR	:	International Covenant on Economic, Social and Cultural Rights

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CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 INTRODUCTION

This study focused on gender sensitivity in teaching and learning outcomes in science and technology. It was a comparative case study of one single and one mixed sex high school in Zimbabwe. The purpose was to explore whether schools promote gender equality in the education of boys and girls in terms of access to, and performance in science and technology subjects. The study therefore, sought to examine the nature of access to and performance in science and technology subjects by comparing access and the academic performance of boys and girls in a mixed sex school and a single sex school. This chapter introduces the study and provides a contextual background to the study. It outlines the statement of the problem, aim of the study, objectives of the study as well as research questions. The chapter also examines ethical considerations, significance and delimitation of the study. Definitions of key terms of the study are also presented in this chapter.

1.2 BACKGROUND TO THE STUDY

The institutionalisation of gender role socialisation tends to engender patriarchy (Hyde, Lindberg, Linn, Ellis & Williams, 2008:494; Hill, Cobertt & Rose, 2010:xiv). This challenge confronts societies the world over in that gender inequalities get constructed through socialisation agents such as the family, peer groups, media and the education system (Hussain, Naz, Khan, Daraz & Khan, 2015:2). Hamieh and Usta (2011:4) single out the family as one of the main architects in developing and inculcating stereotypical gender socialisation. Crespi (2003:5) gives an example of parents who encourage their sons to be brave, dominant and independent. On the other hand, daughters are expected to be submissive and timeously carry out their household chores. The disseminated stereotypes and patriarchal ideologies affect the girl child's self-esteem, capabilities and lock her in social roles traditionally stereotyped as female domains (Molla, 2016:4; Runhare, 2003:133). The implication is that gender role socialisation provides a fertile ground for channelling boys and girls to different subjects at school.

In education, the problem of gender stereotyping which is a product of gender role socialisation started a long time ago with boys studying technical subjects such as Metal Work, Wood Work, Agriculture, Technical Graphics and Building. Boys were encouraged to pursue science subjects, while girls were offered domestic science subjects such as Typing and Shorthand and were encouraged to pursue the arts subjects (European Commission (EC), 2009:7; Kangethe, Lyria & Nyamanga, 2014:281). The gender stereotyping of subjects is a product of the differentiation of female and male social roles which disadvantages learners on the basis of gender at school and later in the field of work (Kangethe, Lyria & Nyamanga, 2014:288; United Nations (UN), 2011:7). Thus, socialisation positions learners to specific subjects by disseminating gender biases and patriarchal ideologies. The consequent sexual division of labour and the relegation of women into feminine domains make schools structures of cultural reproduction (Marinova, 2003:3).

Handley, Brown, Moss-Racusin and Smith (2015:201) observe that gender bias propagated at an early age of the child’s life favours men and contributes to women’s under-representation in Science, Technology, Engineering and Mathematics (STEM) subjects. The scholars point out that, sometimes women subtly or overtly get the message that science and technology subjects are not for them and some in the private and public spheres of life accept it. This view dovetails with that of Hyde, Lindberg, Linn, Ellis and Williams (2008:494) who stress that there is need to address the under-representation of women at the highest levels of STEM fields caused by stereotypes peddled by parents and teachers that girls and women lack mathematical ability. The problem of the girl child’s marginalisation in terms of access to, and performance in science and technology subjects can be viewed as having its roots from the socialisation process which takes place at an early age of the child’s life and is informally perpetuated by the school through the hidden school curriculum.

In a study conducted in England and the Wales, Osborne, Simon and Collins (2003:2) observe that one of the major causes for concern in those countries is the stark nature of the decline in the numbers of females choosing to do science subjects at Advanced Level ('A' Level). In the same vein a study by the European Commission (2009:3) discovered gender inequalities in terms of subject preferences and performance in traditionally male defined subjects in the European education systems. Similarly, Jovanovich and King (2010:491) found that boys perform better than girls in science classes in America.

Mahadevappa's (2012:42) study discovered that gender bias is one of the major issues in many countries, particularly in India. These findings are consistent with those of Castillo, Grazzi and Tacsir (2014:5) who observed a wider gender gap that has persisted over the years at all levels of STEM disciplines throughout the world. Roberts (2014:2) also notes that women in Australia are under-represented in STEM fields in education and the employment sector. This implies that the problem of gender inequalities in the teaching and learning of science and technology subjects at school is a global social problem.

In their study, Chabaya, Rambe and Wadesango (2009:235) observed that there are factors that impede the advancement of women into leadership positions in primary schools. They argue that persistence of gender inequality in Zimbabwe is to blame for the under-representation of women in primary school headship posts. Runhare (2003:133) notes that women in Zimbabwe are generally disadvantaged in terms of access to, and opportunity in science and technology related careers. He (2003:145) observed that females do not get access to certain technical subjects and jobs that are usually dominated by males and blames socialisation for tracking boys and girls into different fields in society. In concurrence, Kambarami (2006:5) asserts that patriarchal values that are embodied in the school curriculum disadvantage girls more than boys. Although Mutekwe and Modiba (2012:280) assert that the Zimbabwean education system is structured to provide education that fosters autonomy to all learners by offering subjects and equipping them with skills deemed necessary for them to take charge of their own destiny, studies by the above authors reveal that gender imbalances are pervasive in many facets of social life including the teaching and learning of science and technology subjects at school.

Gender inequalities constructed through socialisation agents like the family, peer groups, media and the education system influence women's decisions in the private and public spheres of life (Bell, 2008:25). Obiunu (2013:88) notes that the school is a microcosm of patriarchy in that we cannot have a patriarchal society and a gender sensitive unit of that society like a family or a school. Due to the patriarchal nature of society, schools promote and reproduce these patriarchal values through the hidden curriculum. Thus, if society expects the girl child not to be as good as the boy child in science and technology subjects, this is also reflected by the school as a sub-institution of society.

Since Zimbabwe's attainment of independence in 1980, a lot has been done to eradicate gender imbalances (Mutekwe & Modiba, 2015:1). This is evidenced by the country's is participation in conferences such as the Beijing Conference of 1995 and the Southern Africa Development Community (SADC) Protocol on Gender and Development (2008) (Samkange, 2015:1176). In addition, Zimbabwe has ratified the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) (1979) and the African Union Charter on the Rights and Welfare of the Child (ACRWC) (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:35; Samkange, 2015:1174). In addition, the country launched the 2004 National Gender Policy among other policies aimed at promoting the attainment of social justice, equality and equity in all spheres of society (Mutekwe & Zikhali, 2012:42). Despite the fact that Zimbabwe has ratified many international, continental and regional conventions on human rights and gender equity issues, women and girls continue to endure marginalisation in many spheres of life such as education and occupational sectors (Southern African Research and Documentation Centre (SARDC), 2016:viii). Socialisation contributes to this problem through peddling stereotypes and traditional beliefs about men's superiority over women (Molla, 2016:1).

It could be argued that the values that learners acquire at school are shaped by patriarchal practices embedded in the socialisation process. The differentiation of male and female social roles tends to orient learners towards particular subjects at school. Socialisation in and out of the school has considerable influence on boys' and girls' access to and their performance in science and technology subjects at school.

To the best of the researcher's knowledge, very few studies have been conducted on single sex schools and yet these are some of the institutions where gender disparities tend to be more entrenched owing to the homogeneous nature of the school environment (Dale, Esland, Fergusson & McDonald, 2000:21). Against this background this study seeks to explore the nature of access to and performance in science and technology subjects by boys and girls learning together at a mixed sex school and girls at a single sex school in Zimbabwe.

1.3 STATEMENT OF THE PROBLEM

The institutionalisation of gender roles socialisation is engendered in patriarchy (Hyde, Lindberg, Linn, Ellis & Williams, 2008:494; Hill, Cobertt & Rose, 2010: xiv; Mutekwe & Zikhali, 2012:43). This challenge confronts females, not only in Zimbabwe but elsewhere in that gender inequalities are constructed through socialisation agents like the family, peer groups, media and the education system (Runhare, 2003:133; Nhundu, 2007:39). The disseminated patriarchal ideologies and division of labour affect the girl child's self-esteem, capabilities and lock her in social roles traditionally stereotyped as female domains (Mutekwe & Modiba, 2015:1). The sexual division of labour and the relegation of women into feminine domains make schools structures of cultural and gender inequality reproduction (Marinova, 2003:3). Even though Zimbabwean schooling is structured to provide education that fosters autonomy to all learners and despite having what was once purported to be one of the best education systems on the African continent, Zimbabwean girls and women are still under-represented and under-achieving in science and technology related subjects (Runhare, 2003:133; Zvobgo, 2004:70). The channeling of boys and girls in different subjects is a product of gender role socialisation that pervades the private and public spheres of life and is perpetuated by the education system (Mutekwe & Mutekwe, 2012:193). It is in view of gender imbalances evident not only in the education system, but also in many spheres of social life that this study sought to explore how gender socialisation affects boys' and girls' access to and their performance in science and technology subjects at school (Kangethe et al, 2014:280; Marinova, 2003:3; Hamieh & Usta, 2011:3).

1.4 MAIN OBJECTIVE OF THE STUDY

This study examines the extent to which gender socialisation affects access to and performance in science and technology subjects by boys and girls.

1.4.1 Sub-Objectives of the Study

The sub-objectives of the study were to:

- Establish if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- Determine if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- To establish if there is any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at a mixed sex school.
- To explore factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

1.4.2 Research Questions

This study is guided by the following research questions:

- Is there any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school?
- Is there any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school?
- Is there any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at a mixed sex school?
- What factors influence access to, and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school?

1.4.3 Hypotheses

The following hypotheses informed the study:

- There is no significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- There is no significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- There is no significant difference in access to and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school.

1.4.4 Research Assumptions

The study is underpinned by the following research assumption:

There is differential treatment at school which favours boys, thereby giving them an advantage over girls in terms of access to and performance in science and technology subjects. This means that the way teachers perceive and treat boys and girls during formal and informal school curriculum activities make high schools insensitive to equality in terms of boys' and girls' access to and their performance in science and technology subjects. It also means that schools could be agents or sources of some gender based barriers to learning, with a focus on boys' and girls' access to and performance in science and technology subjects.

1.5 SIGNIFICANCE OF THE STUDY

The Southern Africa Development Community (SADC) Protocol on Gender and Development (2008) to which Zimbabwe is a signatory advocated for women to constitute 50% in all state institutions, including the executive by 2015 (Zungura & Nyemba, 2013:204). In line with the Protocol, Sections 17,56 and 104 of the constitution of Zimbabwe among others underscore the need for gender equality as well as non-discrimination and prescriptively set 50% as the representation target of women in decision making positions (Maguwu, 2017:1). In 2013 and 2017 the gender composition of the Zimbabwe cabinets did not signal any alignment with the constitutional imperatives requiring equal representation in state institutions (Maguwu, 2017). The Zimbabwean government formed after the 31 July 2013 elections had 26 cabinet ministers, and out of these only 3 were women, representing 11,5% (International Foundation for Electoral Systems, 2018:3). Maguwu (2017:1) notes that there are no positive measures being taken to rectify gender imbalances resulting from past practices as evidenced by President Mnangagwa's entire cabinet which was announced on 1 December 2017. The 50% representation target for women in the cabinet was not met as only 6 women out of 33 men, were appointed in cabinet, representing 15,3% of the cabinet (Maguwu, 2017). Gudhlanga, Chirimuuta and Bhukuvhani (2012:36) observes that despite Zimbabwe's ratification of international and regional conventions on gender equality and the presence of legislation and policies on non-discrimination, gender inequalities persist in political, cultural, economic and social spheres.

This study is therefore, significant in that it challenges policy makers to consider amending, repealing or revamping existing legislation and policies to change the status quo if initiated changes are limited in scope (Samkange, 2015:1177). Such efforts are likely to usher equal opportunities not only in the political arena, but also to boys and girls in terms of their access to and performance in all subject areas including science and technology.

The achievement of Education for All (EFA) by 2015 is a global mission which is part of the United Nations Millennium Development Goals (MDG), which Zimbabwe ratified (Malaba, 2006:6). However, one impediment to the achievement of universal basic education, especially among developing nations, is the high prevalence of gender inequality in educational access, completion and performance rates (Stromquist, 2005 cited in Runhare & Vandeyar, 2011:4103). With the realisation that the education of girls and women is one unfulfilled fundamental human right, the UN Convention on the Elimination of all forms of Discrimination Against Women (CEDAW), the Convention on the Rights of the Child (CRC) and the Millennium Development Goals (MDGs) all advocate for the principle of gender equality with regard to educational access, completion and performance rates by 2015 (UNESCO, 2005:1). Part Four, Article 14 of the SADC Protocol on Gender and Development (2008) to which Zimbabwe is a signatory states that parties shall enact laws that promote gender equality and gender sensitive educational policies in primary, secondary, tertiary, vocational and non-formal education in accordance with the Protocol on Education and Training and the Millennium Development Goals (MDGs) (SARDC, 2016:xv). As a signatory to these conventions, Zimbabwe, through the 2013 Constitution reaffirms earlier commitments by the Zimbabwe Education Act, Chapter 25, 04 of 1996 to uphold the right to education for every citizen regardless of any differences (The Constitution of Zimbabwe, 2013; Zimbabwe Education Act Chapter 25, 04, 1996). Chapter 2 of the constitution spells out gender balance and emphasises equality as critical to the State (The Constitution of Zimbabwe, 2013, Chapter 2).

The Bill of Rights in Chapter 4 of the new 2013 Zimbabwe Constitution recognises equal treatment and opportunities for men and women in political, economic, cultural and social spheres (The Constitution of Zimbabwe, 2013, Chapter 4). It is in this respect that every Zimbabwean child should be extended the right not only to formal schooling, but also to equal access and performance in all subjects including science and technology. Samkange (2015:1175) points out that laws and the formulation of policy frameworks to give equal opportunities to boys and girls at school should be complemented by campaigns to force their implementation. He further notes that the gender gap currently evident in the political, cultural, economic and social spheres in Zimbabwe is a result of the challenges related to the implementation of some of the laws and policies that promote gender equality and equity. Similarly, UNESCO's (2012b:27) notes that governments' slow pace in delivering on the commitments to girls' and women's marginalisation lies in the challenges to do with implementation of policies and legislation.

In light of the above observations, this study seeks to conscientise policy makers that their mandate should go beyond advocacy but should match theory with practice by including thorough and close monitoring as well as oversight in some cases. This is likely to ensure full implementation of the enacted laws and policies are aimed at combating gender disparity in education. Thus, equality and equity in terms of boys' and girls' access to and performance in all subjects including science and technology is likely to be realised.

The 1987 Education Act in Zimbabwe stipulates that primary education should be free and compulsory. The Act places education in the category of human rights, which as a liberating force should be provided equally to both boys and girls (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:37). As a result of the policy, access to education and enrolment at primary level has increased and the education system has made great strides in giving equal opportunity to both the boy child and the girl child in all facets of the school curricular (Samkange, 2015:1175). It has been observed that there are tendencies by some teachers to employ gender insensitive teaching methods especially during lesson delivery (Samkange, 2015:1175). Such teachers, according to the above author should go through rigorous staff development seminars on relevant gender policies to ensure their smooth implementation. In the same vein, Runhare and Vandeyar (2012:54) suggest policy dialogues as an important vehicle for ensuring that gender imbalances in society are eradicated. They note that policy discussions between stakeholders can go a long way in ensuring that policy duty bearers fulfil their mandate.

This study is therefore significant in terms of conscientising policy- makers on gender issues that their mandate goes beyond just formulating policies but should include rigorous implementation mechanisms that should cascade to all stakeholders including teachers. The knowledge would without doubt help to close the gender gap currently evident in the political, cultural, economic and social spheres in Zimbabwe, including boys' and girls' access to and their performance in science and technology subjects.

To the best of this researcher's knowledge, there is very little research on single sex schools and yet these are some of the institutions where gender disparities tend to be more entrenched owing to the homogeneous nature of the organisations (Dale, Esland, Fergusson & McDonald, 2000:21). Parry's (2012:1) study notes that various scholars' unique findings and recommendations on the gender factor ushered in new platforms for women on the global scene to participate equally with men in both the private and public spheres of life. This underscores the contribution of unique studies in promoting gender inclusivity in society.

1.6 DELIMITATION OF THE STUDY

Although this study focused on gender imbalances in the teaching and learning of science and technology subjects in Zimbabwean schools, only two schools; a single sex school comprising of girls and a mixed sex school consisting of boys and girls learning together were considered. According to Simon (2011:2), delimitation entails what the researcher did and did not do. He points out that delimitations are parameters or boundaries that limit the scope of the study, further noting that delimitations which result from specific choices by the researcher include an explanation about the population studied and the geographic region covered, among other characteristics.

In this study, I did not want to have two single sex schools because the issue is not about boys, so I left boys' high schools alone. I compared boys' and girls' access to and performance in science and technology subjects in the same school as well as from the two schools. I then compared girls from the two schools in terms of access to and their performance in science and technology related subjects. With regards to science subjects, I considered Mathematics, Physics and Chemistry which are traditionally perceived as male dominated (Mutekwe & Zikhali, 2012:43). Technology related subjects which I chose for this study are Building, Technical Graphics, Wood Work, Agriculture and Metal Work. I selected these because teachers tend to categorise them as 'masculine', a practice known as gender typing (Mutekwe & Modiba, 2013:21). I did not consider other technology related subjects offered in Zimbabwean high schools such as Computer Studies, Food and Nutrition and Fashion and Fabrics, which Mutekwe and Modiba (2015:1) refer to as 'feminine' subjects because as I have indicated earlier the issue is not about boys but girls' under-representation and under-achievement in perceived male dominated subjects. With regards to the sample for this study, I concentrated on school-based stakeholders such as heads of schools, their deputies, science and technology subjects Heads of Departments (HODs), science and technology subject teachers as well as learners. These were considered because they were easily accessible to me. I left out parents because they were very difficult to reach as their homes were scattered around the country. Furthermore, other parents were in the diaspora which made reaching them difficult. Findings from this study were therefore generalised to the Zimbabwean population at large.

1.7 DEFINITIONS OF KEY TERMS

Patriarchy: In this study, patriarchy describes a set of social relationships in which men dominate women in the private and public spheres of life (Sartori, 2012:39).

Feminism: In this study, the term feminism refers to advocacy of the rights of women to equality with men in the private and public spheres of life including access to and performance in science and technology related subjects at school (Gemzoe, 2014:9-10).

Sexist language: In this study, sexist language is language that expresses bias in favour of one sex thereby influencing learners' access to as well as their performance in science and technology subjects on the basis of sex (Lei, 2006:87).

Hidden curriculum: In this study, hidden curricular activities include those that are timetabled as well as non-timetabled at school and established or conveyed within the learning environment (Alsubaie, 2012:125).

Gender mainstreaming: In this study, gender mainstreaming refers to efforts or strategies to promote equality between males and females in terms of their access to and performance in science and technology subjects at school (UN, 2002:9).

School culture: In this study, school culture refers to schools' or teachers' attitudes, expectations, traditions and rituals that influence boys' and girls' access to and performance in science and technology subjects at school (Hongboontri & Keawkhong, 2014:66).

Primary socialisation: In this study, primary socialisation is used to refer to a child's Initial learning of cultural norms, values, behaviours, skills, rules and knowledge during the first years of life within a family (Cheney & Pearsey, 2015:17).

Subordinate: In this study, the term subordinate refers to an attempt by social institutions such as the family and the school to portray one gender as inferior than the other resulting in the inferior being made to accept dominant ideologies (Johannsdottir, 2009:31).

1.8 STRUCTURE OF THE STUDY

The study is divided into seven chapters. **Chapter One** is the introduction to the study. It presents the scope of the study, the background history of the study, research problem or area of investigation, aims and objectives of the study, research questions, research hypotheses, research assumptions as well as justification of the study. Definitions of key terms and chapter summary are also discussed in this chapter.

Chapter Two deals with the theoretical perspective adopted with regards to differential access and performance by boys and girls in science and technology subjects at school. The study employed the symbolic interactionism theory as the lens for exploring how society, through gender socialisation affects the education of boys and girls in terms of their access to, and performance in science and technology subjects at school. The theory was chosen because differential treatment at school can be a result of the gender role stereotyping which is socially constructed, developed and modified within interaction situations rather than being predetermined at birth. The theory emphasises that through socialisation of masculinity and femininity roles as well as labelling, individuals develop a self-concept or a picture of themselves which has an important influence on their resultant actions such as choice of subjects as well as performance at school.

Literature review is dealt with specifically in **Chapter Three**. The chapter reviews literature on previous studies in relation to gender sensitivity in the teaching and learning of science and technology subjects at school. The chapter is based on the premise that, the more one reads about research done by others on the same topic or related aspects, the better one can approach and tackle his or her own study.

Chapter Four covers an overview of the research paradigm, design and methodology used in the study on factors that promote gender disparities in the teaching and learning of science and technology subjects at school. The discussion mainly focuses on the different types of research paradigms, designs and methodologies that are available for research purposes and those that are relevant for this study. The chapter also discusses study population, sampling, data collection, data analysis and measures taken to provide validity and reliability in quantitative research as well as trustworthiness in qualitative research.

Chapter Five is on data presentation, analysis and discussion. It presents and analyses data gathered from respondents. Chi-squares and binomial tests are used to present and analyse quantitative data obtained from questionnaires and school documents namely, ZIMSEC, 2016 – 2017, 'O' and 'A' Level final national examinations results. The chi-squares and binomial tests are used to calculate the significant difference in terms of access and performance between boys and girls in science and technology subjects at the single sex and the mixed sex high schools. Qualitative data is presented and analysed entirely in descriptive form.

Summary and discussion of findings are dealt with in **Chapter Six**. In this chapter, the researcher demonstrates the study's contribution to the existing body of knowledge after looking at what other researchers have done in relation to the phenomenon under investigation. The study then filters in some new knowledge that it would have established with regards to the nature of boys' and girls' access to and performance in science and technology subjects at school.

Chapter Seven concludes the study and evaluates the extent to which gender socialisation affects the education of boys and girls in terms of access to, and performance in science and technology subjects at school. It gives a summary of main findings guided by research objectives, research questions, research hypotheses, research assumptions, theoretical framework, literature review and empirical findings. Recommendations for this study as well as suggestions for further studies are given in this chapter.

1.9 CHAPTER SUMMARY

The introduction has established that the problem of the girl child's marginalisation in terms of access to, and performance in science and technology subjects is international. It is evident that education is one of the contributors in perpetuating gender imbalances in society. Through socialisation, the school culture tends to affect the education of boys and girls in terms of access to, and performance in, science and technology subjects. The chapter has revealed that the school is a microcosm of patriarchy in that we cannot have a patriarchal society and a gender sensitive institution like a family or a school. If society expects the girl child not to be as good as the boy child in science and technology subjects, this is reflected by the school which is a unit of the society. Thus, schools may promote what society expects. In this chapter, gender role socialisation has emerged as a powerful determinant not only in terms of children's access to and performance in science and technology subjects, but also in their career trajectories. It is therefore, imperative to point out that a gender balanced society has the potential to foster a gender-neutral education system that can promote equality in terms of boys' and girls' access to and performance in science and technology subjects.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.1 CHAPTER INTRODUCTION

This chapter examines how the school, through gender socialisation could promote gender inequalities in the teaching and learning of science and technology related subjects in Zimbabwean high schools. It unpacks concepts that inform how gender can be understood in the context of this research and also discusses the theoretical framework underpinning the study. The symbolic interactionism micro-sociological perspective was adopted for the theoretical positioning of the study because it helps to understand that people derive and are shaped by the meanings they pick through interaction with their significant and generalised others on a daily life experiences. The theory fits well in this study in that the gendered society is what it is because of what happens to boys and girls in the school. As a significant sub-system of society that engenders patriarchy through differential labelling and treatment of learners according to gender, the school entrenches gender imbalances evident in the teaching and learning of science and technology subjects. The labels that define one’s gender are reinforced by the school setting resulting in the feminine and masculine self-fulfilling prophesy. Thus, through labelling, the school can be regarded as an engendering sub-institution that has the propensity to influence boys’ and girls’ access to and performance in science and technology subjects.

2.2 CONCEPTUAL FRAMEWORK

Conceptual framework according to Jabareen (2009:49), refers to a “plane” of linked concepts, key factors or variables related to the topic under study. Imenda (2014:189) describes a conceptual framework as an end result of bringing together a number of related concepts to explain a given event or give a broader understanding of the phenomenon of interest. Consistent with the above views is Ball and Kitchel’s (2014:190) definition of a conceptual framework as an interconnected set of related concepts about how a particular phenomenon functions. Thus, a conceptual framework comprises of related concepts joined together with the purpose of giving a bigger picture of the phenomenon under study. In this study, concepts which inform how gender can be understood are explored to give a broader perspective on the nature of boys' and girls' access to and their performance in science and technology subjects at school (Imenda, 2014:189). These concepts are sex, gender, gender stereotyping, gender socialisation, gender bias, gender equity, gender inequality, gender sensitivity and gender discrimination.

It is imperative to discuss concepts identified above because they inform how gender can be understood in the context of this study. The concepts are also applied in discussing the theoretical underpinning of the study in this chapter. Furthermore, the concepts are some of the terminologies around the gender factor which are sometimes used in a superficial way.

According to Monkman (2011:10), the terms **sex** and **gender** are often used interchangeably and yet they have different meanings. Cox (2009:5) defines **sex** as one's inherently or hereditary acquired label of identity. It is biologically determined according to certain identifiable physical features which are fixed such as sexual organs. Similarly, Reeves and Baden (2000:3) define sex as the biological characteristics that categorise someone as either female or male. With regards to sex, Kambarami (2006:3) observes that the school, which is a microcosm of society, tends to promote learners' differential access and performance in certain subjects, including science and technology at school on the basis of sex. In light of the above view, this study contends that the school setting treats learners differently based on whether they are males or females, resulting in them accessing and performing differently in science and technology subjects because male and female can be used to label people in a stereotypical manner (Masanja, 2010:1). It is therefore, imperative for social institutions like the school to desist from disadvantaging learners on the basis of their sex when it comes to choosing science and technology subjects and performance in those subject areas.

Gender refers to the social construction of masculinities and femininities (Njogu & Orchardson-Mazrui, 2015:2). Kiprotick and Chang'orok (2015:75) define gender as socially learned behaviours and expectations associated with being female or male. Thus, gender, which is a product of socio-cultural roles entails the behaviour of males and females in the private and public spheres of life. Gender roles assigned to men and women are significantly reinforced at school in a way that influences boys' and girls' access to and their performance in science and technology subjects. Therefore, gender roles are socially constructed or taught and learnt during children's formative years and can be socially deconstructed in the school setting informally as children learn the formal or official school curriculum (Hewitt, 2002:4; Runhare, 2003:145).

Hussain et al, (2015:1) posit that **gender stereotyping** and **gender socialisation** are socio-cultural and related constructs, which are developed and inculcated in the institutional network such as the family and the school during interaction. Agars (2004:104) defines **gender stereotyping** as the act of judging someone on the basis of one's perception of the gender which that person belongs. **Gender socialisation** refers to how children of different sexes are socialised into their respective gender roles (Hamieh & Usta, 2011:6). The above authors concur that gender stereotyping is an outcome of gender socialisation where males are expected to perform outdoor activities such as farming and building whereas females are expected to do domestic chores such as cooking, washing, sweeping and taking care of the youngsters. In the same vein, Kambarami (2006:4) states that the toys that parents buy for their children also aid the gender socialisation process. For instance, a girl child is given female human dolls or kitchen utensils to play with whilst the boy child is given toy cars and other toys that require a lot of physical energy and mental ability to play with. It is this study's contention that a person learns to become and behave like a boy or girl through gender stereotyping. In this study, I regard individuals' daily experiences which shape their self as responsible for their differential treatment in terms of access to and performance in science and technology subjects at school. Zinyemba (2013:17) stresses that the socialisation of strong traditional male superiority and female inferiority values has curtailed women's opportunities to participate fully in the private and public spheres of life. In light of this, I regard gender socialisation as the broad factor that influences boys' and girls' access to as well as their performance in science and technology subjects at school.

Gender bias is defined by Reeves and Baden (2000:2) as any attempt to portray males and females negatively or positively against each other in many spheres of social life. The above definition is in harmony with that of Gudhlanga, Chirimuuta and Bhukuvhani (2012:37) who contend that gender bias is a social order in which women and men portray each other negatively, do not share the same opportunities and the same constraints on full participation in both the economic and domestic realm. Njogu and Orchardson-Mazrui (2015:2) argue that through the process of socialisation, gender roles are assigned to men and women in a manner that creates, reinforces and perpetuates gender bias. The authors posit that norms and practices enshrined in domains of social interaction contribute to fostering not only male dominance and female subordination, but also gender bias in which male superiority and female inferiority values are instilled. The gendered school environment results in fewer women than men pursuing science and technology related subjects. Thus, I regard gender bias as embedded in the school culture and assume that gender bias is responsible for curtailing girls' access to science and technology subjects compared to their male counterparts.

The term **gender equity** is often used interchangeably with **gender equality,** but the two concepts don't mean the same thing. On the one hand, **gender equity** implies fairness in the treatment of men and women by examining the historical and social disadvantages that prevent men and women from sharing a level playing field in the private and public spheres of life (Reeves & Baden, 2000:10). On the other hand, **gender equality** is a social condition in which men and women share the same opportunities, equal rights, balance of power, status and constrains on full participation in both the economic and domestic realm (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:37). Rolleri (2013:4) notes that gender equity necessitates the rethinking by those in authority and intervention of existing policies, programmes and legislation that prevent men and women from sharing a level platform in life. For instance, the provision of leadership training for women or establishing quotas for women in decision-making positions helps to correct the historical and social disadvantages of women (gender equity) in order to achieve gender equality. In this study, I noted that since women are disadvantaged due to patriarchy, there is need to eradicate barriers that prevent them from sharing a level playing field with men in the private and public spheres of life. In that regard, men and women should enjoy the same entitlements because they are both human beings. Thus, it is imperative for boys and girls to be afforded equal opportunities in terms of access to and performance in science and technology subjects.

Gender sensitivity refers to taking an approach that is responsive to different male-female social roles and renegotiating them for the benefit of all gender related social relations and cohesion (Coeterier, 2014:7). Coeterier cites the Madhashi community in Nepal as an example of a gender insensitive community. Among the Madhashi community women are not allowed to sit on the benches during community meetings but on the floor. They are only allowed to give their opinions to the one chairing the meeting after men have already left the venue.

Rolleri (2013:2) indicates that **gender sensitivity** or lack of it is engineered by the differentiation of male and female social roles that begin at home and continues into adulthood through socialisation. Similarly, Kerkhoven, Russo, Land-Zandstra, Saxena and Rodenburg (2016:1) claim that gender sensitivity or lack of it is visible in schools through teachers' attitudes and expectations. Teachers, as significant others at school perceive boys as strong, assertive and brave while girls are viewed as weak, soft and emotionally sensitive (Kambarami, 2006:5). In this study, I note that patriarchal notions of male superiority and female inferiority which are socially constructed during interaction in the family and entrenched by the school environment tend to influence boys' and girls' access to and their performance in science and technology subjects. Teachers can be regarded as significant others in engendering the school environment with the impact being felt not only in science and technology subjects, but also in other spheres of social life such as politics and leadership. A gender sensitive school environment is therefore, necessary to prevent the tracking of girls into the feminine domain and boys in the masculine domain.

Gender discrimination refers to different and unfavourable treatment of individuals on the basis of their gender which denies them rights, opportunities or resources (Raina, 2012:37). Discrimination according to gender is embedded in the interactions that take place in private and public spheres of life. Obiunu (2013:88) shares a similar view in his assertion that gender discrimination refers to letting a person's sex unfairly become a factor when making decisions on resource allocation or other issues in various spheres of life. Thus, gender socialisation by the family and reinforced by the media, school and peers is responsible for the unfair and unfavourable treatment that women often receive at the expense of men. Hussain et al, (2015:7) single out gender socialisation as responsible for inculcating differential social roles leading to gender discrimination. This denotes that gender socialisation is responsible for constructing and reinforcing existing gender imbalances and injustices that pervade the school setting. Thus, gender discrimination at school creates an uneven playing field in terms of boys' and girls' access to and their performance in science and technology subjects.

There is need for a gender-neutral venue and gender-neutral teachers if gender discrimination in terms of boys' and girls' access to and performance in science and technology subjects is to be done away with.

From the foregoing discussion, it is evident that the school as a sub-system of society plays a role in influencing boys' and girls' access to and their performance in science and technology subjects at school. Kangethe et al, (2014:280) observes that the school is one of the society's most powerful socialising forces that fosters, supports, repeats and instils gender stereotypes and cultural values that compel individuals to feel obliged to fit into a pre-determined stereotypical model of masculinity and femininity. This means that gender imbalances which are constructed at an early age are reinforced at school. It is therefore, the duty of the school, family and other socialising agents such as peers and the media to work towards deconstructing the entrenched gender roles.

2.3 THEORETICAL UNDERPINNING FOR THE STUDY

Theoretical framework according to Atkins and Wallace (2012:81) refers to a set of theoretical understanding regarding the functioning of the world in the field of research. Holiday (2001:52) views the theoretical framework as a theoretical perception or discourse which focuses on the main features of the research design and forces the researcher to be explicit about what he or she is doing. The theoretical framework should therefore, be viewed as a set of understanding on the way in which the world functions in relation to research or scientific practice.

Henning, Van Rensburg and Smit (2004:25) posit that a theoretical framework positions the research within the disciplines by enabling the researcher to place the study in the bigger picture of knowledge base in the field of study. A theoretical framework helps to make explicit assumptions about the interconnectedness of the way in which things are related in the world. Swanson (2013:1) argues that a theoretical framework strengthens the study by permitting the audience to evaluate the research assumptions and connect the researcher to existing knowledge as well as guiding him or her on the formulation of hypotheses and the selection of research methods. McMillan and Schumacher (2010:74) point out that a theoretical framework links various aspects of the study including the research design, selection of participants, data collection, presentation and analysis, such that there is a flow in the whole research process and the research findings.

The major function of a theoretical framework is to position the researcher in relation to the research by facilitating the link among various aspects of the study such as the selection of the research design, participants, data collection, presentation and analysis. It helps to delineate the study and position the research in a bigger picture or worldview. Theoretical framework therefore, provides a broader picture to the study and reflects the stance the researcher adopts in the research. Its purpose in research is to frame the work and provide the lens through which one views the world.

In this study, I chose to use the symbolic interactionism theory because it helps one understand that people derive and are shaped into what they are by meanings they pick through interaction in the private and public spheres of life on a daily basis (Gay, 2000:2; Rousseau, 2002:1), especially with people that influence their frame of life or personality such as parents, siblings and teachers. The gendered society becomes what it is because of the gender informed interactions that happen within its sub-systems such as the family and the school. For instance, a boy learns to be a boy and a girl also learns to be a girl through labels which they pick up from significant others such as teachers through interaction. As a significant sub-system of society that engenders patriarchy through labelling, the school entrenches gender imbalances evident in the teaching and learning of science and technology subjects. Therefore, the theory helped me to delineate and position my study in the school setting which is instrumental in gender role socialisation. Thus, the symbolic interactionism theory necessitated a profound exploration of factors that affect the education of boys and girls in science and technology subjects at school (Krotz, 2007:57).

2.4 SYMBOLIC INTERACTIONISM

This study is underpinned by the symbolic interactionism theory which draws from the views of symbolic interactions theorists such as Mead, Thomas, Blumer and Becker, Hargreaves and Keddie (Aksan, Kisac, Aidin & Demirbuken, 2009:902). According to Carter and Fuller (2015:1), the symbolic interactionism perspective is a distinctly American branch of sociology whose fundamental premise includes addressing the manner in which individuals create and maintain society through face-to-face, repeated and meaningful interaction. The perspective is also premised on the view that human beings act on the basis of meanings they attach to objects and events rather than simply reacting either to external stimuli such as social forces, or to internal stimuli such as organic drives (Dong, 2008:15). Carter and Fuller (2015:1) posit that the theory emerged in the twentieth century and its greatest influence was an American Philosopher, George Herbert Mead and his theories about the relationship between self and society. Central to the theory is the idea that the self and the mind are dialectically related, and neither can exist without the other (Turner, 2004:345). Ritzer (2004:56) argues that the self is comprised of two components, the ‘me’ and the ‘I’. The ‘me’ is one’s definition of himself or herself in a specific social role, while the ‘I’ implies one’s intrinsic opinion of himself or herself as a spontaneous individual (Dong, 2008:15). Mead identified two stages which are fundamental in the development of the self-concept in young people. These are the play and game stages. The play stage involves children playing roles that are not their own. Through the game stage, children come to view themselves from the perspective of others. With an awareness of the self, individuals view themselves, as others who are called the generalised others or the significant others.

Mutekwe and Mutekwe (2012:195) contend that the labelling by parents and teachers of girls and boys as certain kinds of people with particular and different personalities, characteristics, academic and social abilities disseminates the inferiority and superiority gender ideology. From the labels, teachers develop different expectations of girls and boys and treat them differently at school. These differential attitudes and expectations are communicated to pupils during interaction at school and are one way through which pupils acquire their self-concepts (Molla, 2016:1). The symbolic interactionism perspective is premised on the view that human beings act on the basis of meanings they attach to objects and events rather than simply reacting either to external stimuli such as social forces, or to internal stimuli such as organic drives (Dong, 2014:25).

At home, parents who are significant others give girls kitchen toys which are pink in colour while boys are given tool sets, guns, trains, cars and engines which are blue in colour as toys (Kiprotick & Chang'orok; 2015:74). The above authors note that girls cook, sweep and clean the house while boys carry out building and carpentry tasks. In the same vein, Kambarami (2006:4) observes that the female dolls and kitchen utensils that parents give baby girls as toys socialise them to become mothers with all motherhood features such as being soft and emotionally sensitive. Boys are given toy cars and puzzle games that require physical and mental stamina in line with their tough future roles as fathers. Hamieh and Usta (2011:12) found out that while girls are socialised to be gentle, submissive, loyal, obedient and subordinate, boys are socialised to be brave, tough and hit back when hit or provoked.

According to Molla (2016:3), the school is the most significant institution that promotes gender inequalities through gender role socialisation in that it entrenches gender roles constructed from an early age. Similarly, Marinova (2003:2) posits that the school environment is embedded with gender role socialisation rooted in the family. Kangethe et al, (2014:280) claim that the school, as a social institution tends to repeat and instil the cultural labels from the family. Reinforced labels by the school are channelled back to the society. One can conclude that there is interchange with regards to what happens in society and the school in terms of gender socialisation. In other words, an individual is not born a boy or girl but learns to be a boy or a girl through symbolic interactionism at home and at school. Therefore, gender role socialisation moves forth and back between the school and society. Patowary (2014:84) states that through gender role socialisation, schools take over from the family and label girls as inferior to boys especially with regards to the teaching and learning of science and technology. Marinova (2003:3) asserts that the school is a reflection of the society in that what happens at school is taken as real by the society. This implies that schools have become one of society's most powerful socialising forces that foster and support societal stereotypes for differential gender behaviour (Kangethe et al, 2014:280).

The school environment is patriarchal in that it creates a learning environment that influences boys to succeed while girls' accomplishments are perceived as less important (Allana, Asad & Sherali, 2010:344). Masanja (2010:1) observes that the school setting contains vast patriarchal attitudes which manifest through encouraging girls to pursue food and nutrition, fashion and fabrics and arts subjects. Boys are encouraged to take metalwork, woodwork and building (Maria, 2015:12). This is why the production, stratification, distribution and consumption of knowledge is said to be in favour of men at school (Kangethe et al, 2014:281). Blumer (1973:86), one of the founding fathers of the symbolic interactionism perspective (cited in Mutekwe & Mutekwe, 2012:196) rejects both societal and biological determinism in the shaping of human behaviour. He contends that meaning arises from the process of interaction rather than simply being present at the outset and shaping future action. Symbolic interactionism places particular emphasis on the notion of the self. The theory suggests that individuals develop a self-concept, a picture of themselves, which has an important influence on their resultant actions (Ritzer, 2004:56). Ritzer (2004:56) states that a self-concept develops from the interaction processes since it is in large part a reflection of the reactions of others, most notably significant others towards the individual. Within the school set up, teachers constitute the significant others whose attitudes, expectations and comments impact on the behaviour of boys and girls. For instance, if teachers say boys are better than girls in science and technology subjects, both sexes tend to eventually fulfil or accept the label. The acceptance of the label is called self-fulfilling prophecy (Turner, 2004:343). Turner (2004:343) argues that individuals tend to react in terms of their self-concepts as communicated to them by others, especially those they esteem highly or significant others.

2.4.1 Justification for Using the Symbolic Interactionism Theory

Gender plays an influential role in the children's development of self-concepts because of their social experiences, particularly the way they are exposed to a gendered social world (Momsen, 2006:15). This means that the meanings that individuals come to perceive themselves in terms of choice of subjects are socially constructed, developed and modified within interaction situations rather than being predetermined at birth. In the process of interaction, meanings which are learnt from others are shaped and reshaped as individuals adjust to their environment (Turner, 2004:345). Dong (2008:14) observes that the resultant meanings are products of interpretive procedures employed by individuals within interaction contexts. By taking the role of the other, individuals interpret the meanings and intentions of others. Through self-interaction, individuals are influenced to access subjects along gender lines at school. Krotz (2007:57) posits that the symbolic interactionism theory can be regarded as an action theory in that individual actions are shaped by culture and society. Action is the ground from which the creation and development of cultural and social realities originates. Thus, the meanings that guide action and cause differential treatment in terms of access to and performance in science and technology subjects at school arise in the context of interaction through a series of complex interpretive procedures.

The implication is that boys and girls are labelled and end up accepting their status. Firstly, an individual is labelled a 'boy' and accepts the status. He is then labelled tough, brave, fearless and superior to women and masters the labels (Anyalebechi, 2016:63). Another individual is labelled a girl who is beautiful, cutie, soft spoken and inferior to boys and accepts the labels (Kiprotick & Chang'orok, 2015:74). According to Njogu and Orchardson-Mazrui (2015:2), if gender stereotyping is repeated regularly, it solidifies and becomes difficult to uproot from mental frames of people. The labels identified above, and many others may affect boys' and girls' choice of subjects and their performance later at school. The labels may also affect boys' and girls' access to and their performance in science and technology subjects.

2.4.2 Self Concept and its Impact on Gender

It is through the process of role-taking that individuals develop a concept of self (Hewitt, 2002:4). Mutekwe and Mutekwe (2012:196) point out that by placing themselves in the position of others, they are able to reflect upon themselves. The idea of self can only develop if the individual can get outside himself or herself experientially in such a way as to become an object to himself (Yu, 2002:159). To do this, they must observe themselves from the standpoint of others, their looking glass self (Turner, 2004:343). The beginning and development of the concept of self lies in the ability to take the role of another. Ritzer (2004:59) distinguished between two aspects in the origin and development of the self, the 'me' and the 'I'; the former is one's definition of himself or herself in a specific social role while the latter implies one's opinion of himself or herself as a whole. In this study, the 'me' can for example, mean a girl within the school environment who has been socialised into domestic roles such as nurturing and carrying out domestic chores. In the school setting and in relation to this study, a girl may be aware that she is socialised into that role because she is perceived as weak, inferior to boys and not good in science and technology subjects.

Ritzer (2004:59) notes that it is the latter which represents an individual's self-concept. It is built up from the reactions of others to one's actions and the way one interprets those reactions. Thus, 'I' can exercise a considerable influence over one's behaviour. For example, an individual who perceives himself as cowardly on the basis of the self-concept he has built up will be unlikely to act bravely in dangerous situations. A female learner identified above who perceives herself as suitable for domestic science subjects such as food and nutrition and fashion and fabrics and not good in science and technology subjects on the basis of the self-concept she has built will unlikely prioritise to pursue science and technology subjects over domestic sciences. For symbolic interactionism, the self is not innate but a product of enculturation from the time of birth.

Mutekwe and Mutekwe (2012:196) present the following summary of the two stages which are fundamental in the development of the self-concept in the young ones. These are the play and game stages. The play stage involves children playing roles that are not their own. For example, children may play the roles of mother, father, teacher, nurse, doctor or engineer. As a result of the roles they play, they often become aware that there is a difference between themselves and the roles they have been playing. Therefore, the idea of the self is developed as the child takes the role of a make-believe other. This is the stage where children use their daily experiences and observations to emphasise the issue of gender differentiation. It is through play that boys become aware that they are different from girls and vice versa. Through symbolic interactionism people raise awareness of the self as ‘boys’ or ‘girls’ rather than knowing themselves in terms of being ‘people’. Boys’ and girls’ differential treatment at school in terms of access to and their performance in science and technology can be said to be rooted in the play stage.

The second level in the development of the self, is the game stage because through playing a game, children come to view themselves from the perspective of the various participants (Mutekwe & Mutekwe 2012:196). In order to play a game such as cricket, soccer, hockey or netball, children ought to be aware of their relationship to the other players. They must place themselves in the roles of the others in order to appreciate their own particular roles in the game. By so doing, they perceive themselves in terms of the collective viewpoint of the other players. Mutekwe and Mutekwe (2012:196) note that people see themselves from the perspective of the generalised other. The development of a conscious self is a significant part of the process of becoming a human being. It gives the basis for thought and action, and the foundation for human society. Without an awareness of the self, the individual cannot direct action or respond to the actions of others. Only by acquiring a concept of the self can an individual take the role of the self. In so doing, thought is possible, since the process of thinking is an inner conversation. Thus, unless individuals are aware of the self, they will be unable to converse with themselves and thought will be impossible.

By becoming self-conscious, people can direct their own action by thought and deliberation. They can set goals for themselves, plan future actions and consider the consequences of alternative courses of action. With an awareness of the self, individuals are able to view themselves as others perceive them. In this way, the significant others who constitute the children’s looking glass self-propagate the gender role ideology whose effect builds the superiority mentality of the boy child at the expense of the girl child who is looked down upon.

It is evident that through playing a game such as soccer, boys become aware that they are different from girls. Girls identify themselves as different from boys when playing a game such as netball. The fact that males and females rarely mix when playing games denotes gender differentiation. It is imperative to point out that even within the game itself, children come to view themselves from the perspective of the various participants.

They build their self-concepts by placing themselves in the roles of the others. They perceive themselves in terms of the collective viewpoints of the other players. At school, learners tend to be influenced by the comments of their peers who constitute the generalised others and teachers who constitute the significant others. Di Prete (2012) cited in Kangethe et al, 2014:292) notes that students succumb to peer pressure because by policing each other, they offer great persuasion for or against access to and performance in science and technology subjects. Similarly, Njogu and Orchardson-Mazrui (2015:2) claim that learners feel obliged to conform to established cultural norms due to fear of losing rewards or being punished for their behaviour by teachers. This underscores the importance of the generalised others and the significant others in the individuals' development of their self-concepts. If an individual has less confidence in science and technology subjects due to gender role socialisation at school, he or she is unlikely to pursue the subjects and their related careers later in life.

2.5 CHAPTER SUMMARY

The chapter discussed and clarified complex and controversial concepts such as sex, gender, gender equity and gender inequality among others. It was evident from the discussion that society, through gender socialisation by its sub-systems like the family and the school plays a role in influencing boys' and girls' access to and their performance in science and technology subjects. The symbolic interactionism theory was chosen for this study because the meanings that individuals come to perceive themselves in terms of their choice of subjects at school are socially constructed, developed and modified within interaction situations rather than being predetermined at birth. From an early age, boys are depicted as tough and given toy guns and cars to play with while girls are perceived as soft and are given female dolls and kitchen utensils to play with. These patriarchal attitudes propagated in the family are perpetuated by teachers who are significant others in the school setting.

Therefore, the school is an engendering institution that influences boys to believe that they are superior to girls and both sexes tend to fulfil the labels. The labels tend to boost boys' confidence thereby enhancing their access to and performance in science and technology subjects at the expense of girls at school. The theory emphasises that individuals develop a self-concept or a picture of themselves which has an important influence on their resultant actions such as choice of subjects at school from the interaction processes with others most notably significant others or those they esteem highly. In this regard, boys' and girls' exposure to the gendered social world at school tends to influence their access to and performance in science and technology subjects. The symbolic interactionism theory was presented as a guide to direct the research process. It provided the lens through which the study was viewed and conducted. From the theory, it is evident that the interaction that takes place at school is the most powerful socialising force that fosters and supports societal stereotypes for gender behaviour.

CHAPTER THREE

REVIEW OF RELATED LITERATURE

3.1 CHAPTER INTRODUCTION

This chapter reviews literature on previous studies in relation to gender sensitivity in teaching and learning outcomes in science and technology. The chapter is based on the principle that, the more one reads research done by others on the same topic or related aspects, the better one can approach and tackle his or her own research. The main purpose of literature review is not only to build on the strengths of existing studies, but also to critique some of the views expressed by preceding scholars. The chapter commences by exploring the role of agents of socialisation in this study because they do not only engineer the differentiation of male and female social roles, but also influence people's vision and version of gender. The review adopts the funnel approach which examines gender imbalances in science and technology, beginning with the global or world perspective followed by the African view and lastly the Zimbabwean perspective. An exploration of interventions to gender inequalities in the public sphere is then followed by the government of Zimbabwe's interventions to domesticate gender imbalances.

3.2 ROLE OF PATRIARCHY AND GENDER INEQUALITY IN EDUCATION

Patriarchy is the source of gender inequalities that are pervasive in the private and public spheres of life (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:37). Sivakumar (2008:2) notes that due to patriarchy women are portrayed as the weaker sex. The negative portrayal of women due to patriarchy and their consequent marginalisation has created a gulf between men and women (Sartori, 2012:39). Patriarchy can be regarded as the reason for women's underrepresentation in science and technology subjects (European Union (EU), 2012:44).

Kangethe et al, (2014:280) single out socialisation as the main culprit in constructing and reinforcing gender inequalities and patriarchal values in society. In light of this, socialisation deserves a comprehensive exploration in this section. This is because patriarchy and gender inequalities which have permeated many facets of social life are products of socialisation that starts at an early age and has a lasting impact in people's lives. Thus, society can be said to have acquired much of its patriarchal ideologies, gender inequalities and other gendered values from the socialisation process.

3.3 SOCIALISING AGENTS AND THE ENGENDERING OF PATRIARCHY IN EDUCATION

The differentiation of female and male social roles is constructed through socialisation agents like the family, peer group, media and the family (Runhare, 2003:133). This observation is corroborated by Mutekwe and Zikhali (2012:43) who posit that the challenge confronting girls or women in Zimbabwe is that in most families the gender role socialisation practices tend to engender patriarchy.

This implies that gender stereotypes which are sources of gender imbalances are socially constructed, hence the need for their social deconstruction.

3.3.1 Role of the Family in Gender Socialisation: Implications for Education

Hill, Cobertt and Rose (2010:xiv) blame the family, social and environmental factors for the under-representation of women in STEM subjects. Hyde et al, (2008:494) argue that the under-representation of women at the highest levels of STEM fields is caused by stereotypes peddled by parents and teachers that girls and women lack mathematical and scientific ability. The family socialises girls that they are not as good as boys when it comes to performance in STEM subjects. Hussain, Naz, Khan, Daraz and Khan (2015:2) contend that the problem starts with parents who encourage their sons to be brave, dominant and independent during socialisation. On the other hand, daughters are expected to be submissive and timeously carry out their household chores. This suggests that the family is partly responsible for the under-representation of women in the identified fields.

Canagarajah, Newman and Bhattamishra (2001:15) studied gender inequalities in rural Ghana and Uganda and concluded that gender inequalities are a product of environmental factors. They singled out primary socialisation as one of the pillars responsible for constructing gender roles. This point of view dovetails with this study's argument that boys' and girls' access to, and performance in science and technology subjects tends to be affected by many factors, including the family which is one of the socialising agents.

Mosley (2004:97) also studied gender biases and found out that in Ethiopia, cooking, cleaning and fetching water are considered feminine domains while agricultural activities (mainly ploughing) are considered masculine roles. These roles are constructed and reinforced at family level. Mosley's findings are similar to those of Nyoni (2004:40) who asserts that the socialisation of gender roles which starts at home produces rigid and inflexible expectations of men and women. Similarly, Mutekwe (2007:13) notes that children's textbooks reinforce gender role stereotypes acquired from primary socialisation. This means that gender role stereotypes which are a result of primary socialisation are perpetuated in the educational arena. It is therefore, the duty of not the school and the family to work towards deconstructing these stereotypes.

Mutekwe and Mutekwe (2012:193) note that the issue of gender inequality between women and men stems from primary gender role socialisation where the family is a major factor in constructing, structuring and reproducing patriarchal values which disadvantage girls compared to boys. The family's belief in the genetic inferiority of girls is a key factor in influencing their academic performance, access to schooling, withdrawal and dropout from school. This view is consistent with that of Zinyemba (2013:34) who contends that families' gender role expectations are at the centre of curtailing women's opportunities to participate fully in the private and public spheres of life. These provide insights on the families' role in propagating patriarchal ideologies that are responsible for differently allocating boys and girls into highly gender polarised social roles. It is therefore, imperative for a study of this nature to raise an awareness of patriarchy in the private and public spheres of life and dismantle the notion that men are superior to women. If this notion is eradicated, an even playing field in terms of access to, and performance in science and technology subjects may be created.

3.3.2 Education as an Agent of Gender Socialisation

Obiunu's (2013:888) study found out that what students learn at school depends on gender ideologies embedded in the curriculum. Meyer (2008:31) concurs and asserts that patriarchal values embodied in the school curriculum disadvantage girls more than boys. Similarly, Allana, Asad and Sherali (2010:346) regard books as a major vehicle through which gender biases are perpetuated and argue that books should be the starting point in society's quest to achieve gender neutrality. In the same vein, Maluwa -Banda (2003:13) notes that gender stereotyping can be traced in some of the school textbooks which peddle the notion of male superiority over women. Therefore, the education system can be regarded as responsible for creating an uneven playing field in terms of not only subject choices and performance at school, but also in relation to career paths to follow.

Mutekwe, Modiba and Maphosa (2011:133) examine factors affecting female students' career choices and aspirations in Zimbabwe. They point out that the school curriculum and teachers are the main players in propagating patriarchal ideologies while socialisation compounds the school culture's influence. Mutekwe and Modiba (2015:1) also found that teachers engage in gender typing of subjects resulting in subjects like Mathematics, Pure Sciences and Technology falling in the masculine category while the feminine domain includes subjects like Home Economics, Humanities and Typing. This means that what students learn at school is shaped by gender ideologies embedded in the curriculum in both explicit and hidden forms. Thus, the gendered school curriculum results in fewer women than men pursuing science and technology related careers.

It is important to examine the existing curricula in terms of how far they incorporate gender issues in pedagogy (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:38). Men and women should be accorded the same opportunities in the economic and social realm and boys and girls should also be given the same opportunities in relation to access to, and performance in science and technology subjects at school. The school curricula should project a positive image of both sexes if gender disparities are to be eradicated (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:38). With reference to this study, gender neutral school curricula would advocate inclusion and fairness in terms of boys' and girls' access to, and performance in science and technology subjects.

In addition to sexist language in official textbooks, gender manifestation during classroom discourse has a direct effect on students' self-esteem (Nhundu, 2007:39). Lei (2006:87) argues that the use of pronouns such as 'he' to represent 'mankind' and 'manpower' to represent 'human resources' have the propensity to destroy the self-esteem of the girl child, thereby rendering her inferior, whilst creating a superiority complex in the boy child. It could be argued that sexist language in school textbooks does not help to generate respect for individuals regardless of sex. It is therefore, imperative to dismantle male superiority complex and replace it with the notion of gender equality in the private and public spheres of life, including boys' and girls' access to, and their performance in science and technology subjects at school.

Nyoni (2004:40) asserts that the socialisation of gender roles which starts at home is reinforced at school. Similarly, Mutekwe and Zikhali (2012:42) stress that the educational curriculum in Zimbabwe is used to maintain the status quo of patriarchy as a form of gender imbalance in society through gender typing of subjects. This means that gender role stereotypes which are a result of primary socialisation are perpetuated in the educational arena. It is the duty of the curriculum designers and implementers to work towards changing the status quo.

Booher-Jennings (2008:149) criticises schools for being significant sources of gender socialisation. Teachers and curricula send out various messages that reinforce the qualities traditionally ascribed to females and males, and students engage in recess and other extra-curricular activities that do the same thing. This means that schools socialise children by teaching them not only their formal curricula, but also the hidden curriculum that perpetuates gender imbalances constructed at home. Thus, the school culture can be said to be responsible for tracking girls into the feminine domain and boys into the masculine domain.

3.3.3 Peer Group as an Agent of Gender Socialisation

The peer group is one of the socialisation agents that is responsible for the differentiation and reinforcement of male and female social roles (Runhare, 2003:133). This means that patriarchal ideologies which are responsible for gender typing of subjects are socially constructed and perpetuated during peer interaction. Due to the peer group influence, the education of boys and girls tends to be affected in terms of their access to, and performance in science and technology subjects at school.

Nhundu (2007:39) argues that male teachers and boys exhibit patriarchal attitudes resulting in the school environment gender being biased. Patriarchal values embodied in the home environment reinforce male dominance through continued gender orientation of boys and girls via interaction as peers at school. This confirms the role of the peer group in creating an uneven playing field for boys and girls at school. This results in the girl child developing a low self-esteem which consequently affects her access to, and performance in certain academic subjects.

According to the European Commission (2009:38), subject choices are to some extent driven by the desire to belong to a particular masculine or feminine person who tends to punish non-conformity to the peer's norm. Similarly, Hussain et al, (2015:3) posit that gender socialisation is reinforced by the peer group which is one of the dominant agencies of socialisation. Peers perpetuate gender ideologies embedded in society either in explicit or hidden forms. Thus, peers should be conscious of what they say in order not to perpetuate gender disparities. In other words, gender imbalances constructed and reinforced during peer interaction can affect learners' access to, and their performance in perceived masculine and feminine subjects.

A study by Kangethe et al, (2014:292) notes that students succumb to peer pressure through policing and ridiculing each other, thereby offering great persuasion for access to and performance in certain subject areas. This means that peer interaction, just like the family, education and the media has a propensity to socialise learners into believing that one gender is inferior to the other. Therefore, gender role stereotypes and other gender imbalances are a result of gender role socialisation perpetuated by peer socialisation. Thus, the peer group can create conditions which disadvantage girls and restrict their participation in many spheres of life, including access to and performance in science and technology subjects at school.

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3.3.4 Media and Gender Socialisation

A number of studies have revealed the negative portrayal of women in the print media, television advertising, soap operas and dramatic series. Studies on images of women in magazines reveal that stereotypical images have been remarkably consistent over the past three decades (Byerly & Ross, 2006:17). Men are portrayed as authority icons whose desires are realised through the beautiful but subordinate females (Inter Press Service, 2002:7).

Prominent in studies by the Inter Press Service (2002:7) is the issue of good looks by ensuring a regular diet, slimming tips and articles on catching and keeping a boy-friend, to mention just but a few of the many things women would do in order to please men. Those women involved in paid work are confined to less important work such as modelling and fashion, while men are involved in prestigious occupations which symbolise their power.

There are numerous studies on television portrayal of gender. A major observation made in these studies is the prevalence of sexism in advertising, whereby beautiful or naked women become a package of the product being advertised (Sharma, 2005:32). According to Kumari and Joshi (2015:45), the television medium seeks to define women in relation to men, whilst men are defined in relation to their work, their creativity or play. Sharda (2014:43) argues that the commercialisation of media has been largely responsible for stereotyping women and has caused a lot of harm to the image of women within the society. Women are generally portrayed in limited roles than their male counterparts. This negatively affects the self-esteem of women in society.

Kiprotick and Chang'orok (2015:73) observe that television portrays women as the ones who 'take care' while men are shown as the ones who 'take charge'. Thus, an impression is created that the home is the place where a woman's expertise is mostly valued, thereby reinforcing the stereotype that a woman's place is in the home (Kiprotick & Chang'orok, 2015). Dramatic series portray women as being better suited to being married and keeping a home rather than venturing in the world of business or politics. The main stereotypes of women characters in dramatic series have been found to be the good wife, prostitute, victim, decoy, witch and mother (Sharma, 2005:32; Davtyan-Gevorgyan, 2016:1). These media images have a negative impact, particularly on young women who do not have positive role models to emulate in society (Kangethe et al, 2014:290). In their study, Hamieh and Usta (2011:6) argue that women are projected as tools of glamour and fashion in television series. This creates the impression that women's roles are illusionary. Thus, the female body is displayed and filmed for the male gaze in order to provide erotic pleasure and ultimately a sense of control over her.

The study of the portrayal of women in both print and electronic media is important to this study in that it depicts the pervasiveness of gender bias in various spheres of social life (Debusscher, 2015:21; Patowary, 2014:84). Thus, the family, education, peer group and media are tools of socialisation, among many, which patriarchal societies utilise to advance men's supremacy and women's marginalisation. It is necessary to eradicate gender biases in these socialisation agents because it is harmful not only to women, but also to the girl child who will grow up without any positive role models in society. Consequently, the education of boys and girls in terms of access to, and performance in science and technology subjects may be affected due to the girl child's low self-esteem and men's perceptions of women as the weaker sex.

From the arguments proffered by various scholars, it has been noted that despite decades of gender activism, gender disparities are still embedded within the social, political and economic systems globally. In line with the tenets of the liberal feminists, the education system can be a solution if it advocates for equal access to the formal curriculum. Hence fairness in terms of boys' and girls' access to, and performance in science and technology subjects at school should be advocated.

3.4 GENDER EQUITY IN EDUCATION: GLOBAL, REGIONAL AND LOCAL PERSPECTIVES

The problem of gender inequalities in the teaching and learning of science and technology subjects at school is a global phenomenon (Moss-Racusin et al, 2012:52). This section examines the state of gender equality in educational globally, regionally and locally.

3.4.1 Global Landscape on Gender Equity in Education

After analysing data collected as part of the National Educational Longitudinal Study, Parry (2012:1) concludes that teachers tend to rate white girls' mathematical abilities lower than those of white male students, even when the girls' grades and test scores are comparable to boys. The evidence found showed consistent bias against white females, which although relatively small in magnitude, suggests that teachers hold the belief that Mathematics is easier for white males than it is for white females. These findings are consistent with those of Gentile (2013:1), who analysed a study conducted by the American Research Universities as well as another funded by the National Science Foundation of America and found discrimination of women in pedagogy involving STEM subjects. Gentile's (2013:1) analysis also revealed gender bias in staffing at workplaces. It was found that both male and female scientists view gender discrimination as a factor in women's decision to choose a science related career or to choose Biology over Physics, Engineering and Technology at school. The above scholars concluded that there is gender discrimination in pedagogy involving Mathematics and science subjects as well as career choices and hiring of staff at workplaces.

Volman and Eck (2001:613) state that there are gender differences which favour males in Information, Communication and Technology (ICT) teaching and learning in primary and secondary education. Sanders (2005:3) also laments women's low representation in technology related fields in the United States and the world over. Thus, participation and performance in technology learning and activities is tilted in favour of males. The challenge of gender imbalance and women's under-representation in technology related fields is a major worry globally. There is consensus among scholars that learners' access, participation and performance in technology learning and activities is tilted in favour of males and more needs to be done to harness women's under-representation in technology related fields (Volman & Eck, 2001:613; Sanders, 2005:3).

Roberts (2014:2) notes that women in Australia are under-represented in STEM fields in education and the employment sector. Profound gender disparities were found to be more evident in disciplines such as Mathematics, Engineering and Computing. Roberts (2014:2) identifies a myriad of causes of gender imbalances in terms of access to, and performance in STEM fields. These include teacher bias, cultural stereotypes, ignorance of what these careers entail as well as lack of encouragement from teachers and parents. It is clear from the study's findings that parental role, cultural factors and the school culture are major factors in the marginalisation of women in STEM fields. Roberts notes that the under-representation of women in STEM fields is a global challenge that requires urgent mainstreaming (Roberts, 2014).

A study conducted by Castillo, Grazzi and Tacsir (2014:5) revealed a wide gap between women and men at all levels of STEM disciplines in Latin America, Europe, Asia and the Oceania. Although some progress has been made there was evidence of the under-representation of women in the fields identified above. This problem is more acute at the senior-most levels of academic and professional hierarchies (Castillo, Grazzi & Tacsir, 2014:5). This study brings to the fore the need to eradicate the under-representation of women in STEM disciplines and create an even playing field for men and women with regards to access to, and performance in STEM subjects at all levels of academic and professional hierarchies.

In their study, Koirala and Acharya (2005:8) observed lack of support from teachers, parents and colleagues as well as a skewed curriculum as stumbling blocks towards girls' access to, and participation in Science and Technology Education (STE) subjects in Nepal. The study also identified lack of specific policy to harness gender gaps and imbalances as one of the forces standing in the way of girls' access to, participation and performance in STE subjects in Nepal. These findings bring us to the conclusion that gender differences which favour the boy child in Nepal in terms of access to, and participation in STE subjects. It is therefore, fundamental for measures in the form of policy frameworks to be instituted to help close this gap.

After collating results from various studies and undertaking their own study, Jovanovic and King (2010:491) found that boys perform better than girls in science classes. Their findings match with those of Moss-Racusin, Dovidio, Brescoll, Graham and Handelsman (2012:74) who found that a stark gender disparity persists within academic science. The scholars outlined measures that should be instituted to help close this gap. One of the measures suggested is increased training and retention of women who are starkly under-represented within many fields of science, especially among the professoriate. After comparing results undertaken by various researchers internationally, these scholars found consistent bias against females in pedagogy involving science and technology.

Hill et al, (2010:xiv) posit that negative stereotypes about girls' and women's abilities in Mathematics and science subjects persist despite girls' and women's considerable gains in participation and performance in these areas during the last few decades. They point out the stereotype that girls are not as good as boys in Mathematics, and that scientific work is better suited to boys and men are prevalent. These findings support the claim that, even the education system reinforces and perpetuates gender disparities via the socialisation process globally.

A study by Mabela (2013:1) revealed that less women in South Africa are employed and economically active than men. This implies that gender bias is pervasive in many facets of social life and the employment sector is one of them. The study by Mabela (2013:1) provides the present insights into how gender socialisation affects learners' access, participation and performance in science and technology from a broader perspective.

Gender bias negatively affects male-female relations in society as a result of the manner in which they are portrayed (Wasosa's, 2010:143). Christ (2013:10) echoes the same sentiments by noting that patriarchy creates male dominance, resulting in sour male-female relations. Sy (2012:2) examines how gender inequality results in under-representation of women in certain subjects in education. The three scholars concur that the negative portrayal of women helps to entrench gender inequality and promote hostility to the detriment of societal development. It is therefore, crucial for society to work together and redress the under-representation of women in many spheres of life, including science and technology subjects.

Jayachandran's (2014:1) examined the roots of gender inequality in developing countries with particular focus on cultural factors that prop up favouritism towards males. Taking a global outlook, he focused on an array of pertinent cultural issues with regards to gender biases in society. He also noted that gender bias in favour of boys is evident in the teaching and learning of various subjects at school including science and technology. It is clear from the study's findings that cultural factors are major factors in the marginalisation of women in society.

3.4.2 Gender Equity issues in Sub-Saharan Africa

In Sub-Saharan African (SSA) countries education is tilted in favour of men in terms of access to, and performance in science and technology related subjects. The study found that women continue to be channelled to the so called 'women's' occupations such as nursing, secretarial jobs and social work while. Occupations in Engineering, Physics and the so called 'hard sciences' continue to be dominated by men. The implication is that what students learn at school as well as their future occupations depend on ideologies about gender that are embedded in the school culture. Thus, schools are responsible for gender typing of subjects that culminate in the under-representation of females in science and technology related fields of work. Therefore, there is need to address the representational aspect in education and labour sectors.

Miroux (2011:7) asserts that in many African societies, women are not considered important and recognised human beings who must be accorded respect and dignity. The literature, especially that written by men tends to create women characters that are docile, devoid of reasoning and incapable of performing certain tasks in various spheres of social life. Such notions are destructive and create sour gender relations which threaten solidarity, harmony, social cohesion and national development as divided people are unlikely to co-operate on issues to do with social prosperity. It is in this context that society is accused of reinforcing existing gender inequalities by continuing to create a gulf between men and women.

The UN (2011:3) notes that Kenya does not have specific policy on gender mainstreaming in science and technology apart from some general provisions which are not strong enough to eradicate existing gender inequalities. This observation is consistent with the findings of a study undertaken in Uganda where gender disparities were still found to be embedded in many spheres of social life including science and technology (UN, 2011:3). In view of the above observations, it is fundamental for governments, non-governmental organisations and other stakeholders that champion the rights of women to redress gender inequalities that have been entrenched in various spheres of life. Their efforts can help to close the gender gap in terms of access to and performance in science and technology subjects.

Afolabi (2007:6) observes that there are significant gender gaps in Nigeria's many sectors of life and that womanhood is denigrated. The study also found that women are reduced to second class citizens in many spheres of social life. It is important to point out that Nigeria's commitment to introduce the National Gender Policy (NGP) to eliminate discriminatory practices that are harmful to women is a testimony that governments do not just fold their hands and watch in the face of pervasive discriminatory practices (Makama, 2013:1). Therefore, measures from whatever sector to harness gender disparities in society are applauded.

Although the 1995 Malawi constitution guarantees equal rights to men and women, a study by Maluwa-Banda (2003:3) observes that in reality, gender disparities still exist in many spheres of social life, including learners' access to science and technical components of the school curriculum. This shows that gender inequalities in science and technology education are widespread, not only in developed countries but also in sub-Saharan African countries. It is therefore, essential that a concerted effort by all countries is made to curb gender disparities in the best interest of creating a gender-neutral society.

Research by Koketso (2015:iii) uncovered low graduation of girls in STEM disciplines in Botswana's post-secondary institutions. This is attributable to the rigid patriarchal social systems as well as other socio-cultural factors and practices. In addition to socialisation and social practices, the study also identifies the school curriculum as one of the institutionalised forms responsible for creating disparities in the education of boys and girls in Botswana. It is clear from the research findings that STEM subjects in Botswana's schools are channelled to boys and this ultimately leads to gender disparities in terms of access to, performance and graduation in STEM disciplines. This shows that the representation of women in STEM fields in Botswana's education systems needs to be addressed in the best interest of realising equality and creating an even playing field in STEM teaching and learning.

After gathering data on students' enrolment in science and technology subjects at the University of Swaziland (UNISWA), UNESCO (2012a:7) found that UNISWA's faculty of science had the smallest proportion of women students compared to other faculties. It was found that there was only 20% of women in the 2010/11 academic years and that teachers in Swaziland held the belief that science and technology subjects were easier for males than females. Consequently, educationists tend to encourage the boy child to enter into a science and technology related career later in life more than they do to the girl child. This means that gender discrimination that starts from primary socialisation and is perpetuated by the school culture is a factor in women's decision not only in pursuing science and technology subjects at school, but also in choosing a science and technology related career later in life.

According to Moletsane and Reddy (2011:2) there is generally low participation and success of girls in Mathematics and science subjects in developing countries such as South Africa. They blame teachers' perceptions for this state of affairs as they believe that boys are naturally more inclined to excel in Mathematics and science subjects than girls. It could be argued that teachers have the capacity to dismantle patriarchal notions that the girl child is less gifted in Mathematics and science subjects than the boy child. The eradication of such a belief has the propensity to improve the representation, participation and performance of girls in Mathematics and science subjects.

Segalo's (2015:70) study acknowledges that since the advent of democracy in 1994, there is change in South Africa as women's rights are increasingly being upheld and recognised. However, despite the many positive changes that have taken place in the new dispensation, the promise of gender equality in almost all spheres of life has not been fully met. Although gender disparities are still evident in some spheres of life, it is pleasing to note that South Africa has made strides to ensure that men and women compete at the same level in many spheres of life, including science and technology education at school.

Maia (2008:1) notes that there are major economic and socio-cultural barriers to equal opportunity in education which curtail women's social, economic and personal development in Mozambique. Although public primary education in Mozambique is compulsory and free, girls lack family and social encouragement to pursue their studies (Maia, 2008). In addition, the school curriculum is biased in favour of the boy child. Consequently, enrolment of girls including those at the upper levels of primary education is very low. An overhaul of the school curriculum and pedagogy are suggested as some of the measures to redress the status quo. This means that the education system, as one of the factors responsible for reinforcing gender inequalities should be revamped so that an even playing field in terms of enrolment of learners by gender at school as well as their access to, and performance in all subjects offered is achieved.

3.4.3 Gender Equity in Zimbabwe

Runhare (2003:133) observes that women, the world over are generally disadvantaged in terms of access to, and opportunity in, science and technology related careers. He cites sexual division of labour constructed through socialisation by the family, peer group, media and education as responsible for tracking boys and girls into different fields. In the same vein, Mutekwe and Modiba (2012:279) lament the unequal distribution of boys and girls in certain subjects studied at school and the consequent unequal distribution of men and women in the occupational structure. Thus, gender imbalances in terms of access to, and performance in, science and technology subjects can be said to be structured and reinforced via the school curriculum among other socialisation agents.

Zvobgo (2004:70) notes that despite having one of the best education systems in the African continent, the stereotyping in Zimbabwean schools interferes with students' choice of school subjects, occupational choices, and in general, their life chances. Gudhlanga, Chirimuuta and Bhukuvhani (2012:38) also emphasise that it is important to examine the existing curricula in terms of how far they incorporate gender issues in pedagogy. This means that the school culture perpetuates gender imbalances. It is therefore, significant to revamp the schools' curricula if gender neutrality in terms of access to, and performance in science and technology subjects is to be realised.

Machingura (2006:21) as well as Mavhunga (2009:31) claim that some experienced Zimbabwean teachers have, through language use produced and peddled some gender role ideologies which differentially reinforce boys and girls to pursue different subjects as well as highly polarised gender roles. Thus, the school environment is not a gender-neutral venue handled by gender neutral umpires, as it has adversely affected the education of boys and girls in terms of access to, and performance in science and technology subjects.

The studies by Mutekwe and Zikhali (2012) as well as Mutekwe and Modiba (2013) have illuminating insights into the present study in so far as they address the plight of the girl child in a patriarchal environment and in education. They identify the tracking of boys and girls into different fields at school as one of the factors for the problems bedevilling the girl child in education. Thus, the channelling of boys and girls to different subjects should be stopped because it is discriminatory. A gender-neutral education system would ensure equality in all spheres of society including science and technology subjects.

Wasosa (2010:143) argues that authors should turn the tables and portray females in a positive way as they do with males. His perspective is plausible given women's history of marginalisation in literature. Writers of books play an important role in the achievement of gender parity in society. It is therefore, important for authors of books and for all stakeholders to project a positive image of women and the girl child as well as their accomplishments in the public domain in order to change the status quo.

A study by Marinova (2003:3) revealed that the school curriculum and teachers are the main culprits in propagating patriarchal ideologies while socialisation compounds the school culture's influence. These findings are consistent with those of Mutekwe and Modiba (2015:1) who found that teachers engage in gender typing of subjects resulting in subjects like Mathematics and Pure Sciences falling in the masculine category while the feminine category includes subjects like Home Economics, Humanities and Typing. This means that what students learn at school depends on ideologies about gender that are embedded in the curriculum in both explicit and hidden forms. Thus, the gendered school curriculum results in fewer women than men pursuing Mathematics and science related careers.

Although these scholars did not widen their discussions on conditions for alleviating the effects of gender inequality, their study has provided insights and literature to the present study. It is indeed a fact that there is need for gender-sensitive discourses as they recommended. This study therefore, calls for gender-sensitive authors who write books with the positive agenda of dismantling the already entrenched social roles and substitute them with the progressive ones which portray men and women as equal. This way a gender-neutral society and learning environment in science and technology subjects at school can be realised.

Mashiri (2013:95) posits that the prevalence of ideologies justifying female subordination promotes the problem of gender-based violence. Male tacit supremacy which has historical extractions is responsible for the creation of negative female images. The present study's focus is consistent with his argument that gender based violence is a symptom of underlying gender inequalities and power imbalances which affect every community globally and Zimbabwe is no exception. In the same vein, gender disparities in science and technology teaching and learning are a symptom of underlying power imbalances which affect the global community. In other words, gender-based violence and gender inequalities are a result of unequal power relations which pervade almost the global village.

3.5 THE STATE OF GENDER EQUALITY IN OTHER LIFE SPHERES

A study by Radu and Chekera (2014:3) revealed that there is sexual harassment and gender discrimination within Zimbabwe's newsrooms and media houses. They lament the absence of policies and codes of ethics to deal with the situation. Their research provides statistical data on sexual harassment and gender discrimination. Although they did not give solutions to women's predicament, their study shows the pervasiveness of gender discrimination in many spheres of social life.

Chabaya, Rembe and Wadesango (2009:235) examined factors that impede the advancement of women to leadership positions in primary schools. They blame the persistence of gender inequality in Zimbabwe for the under-representation of women in primary school headship posts. They argue that the influence of gender role stereotypes manifests itself in the form of low self-esteem, lack of confidence and women's beliefs that family roles override all other roles. Their study supports this study's core argument that gender discrimination is considered a barrier to women's advancement in many aspects of social life not only in Zimbabwe, but globally.

3.6 INTERNATIONAL CONVENTIONS ON GENDER EQUALITY

Rampant violations of human rights and freedoms prompted the United Nations General Assembly to produce a document that, for the first time articulated the rights and freedoms to which every human being is entitled (United Nations (UN), 2015a:iii; Stromquist, 2001:52). According to UN (2015a:iv), the Universal Declaration of Human Rights (UDHR) which was adopted in 1948 stems from the United Nations' founding charter which stipulates that the international community has a duty to uphold and defend human rights. Several international, continental and regional conventions were subsequently adopted which among other objectives seek to attain gender equality in society, the education system as well as in the teaching and learning of Mathematics, Science and Technology.

3.6.1 Interventions to Gender Inequality in Society

This section discusses interventions on gender inequality in society with specific reference to developed countries and the Sub-Saharan region.

3.6.1.1 Developed countries

The UDHR (1948) is a global commitment which among other objectives seeks to harness human rights abuses and ensure that all people gain freedom, equality and dignity (UN, 2015a:vii; SARDC, 2016:xiv; Moletsane & Reddy, 2011:1). It was a timely intervention to gender inequality in society that seeks to achieve and strengthen tolerance, respect for human rights and fundamental freedoms in the public sphere (UN, 2015a:4; Yeba, 2015:180).

Article 01 of the UDHR (1948) convention stipulates that all human beings are born free and equal in dignity and rights (UN, 2015a:4; Moletsane & Reddy, 2011:1). They are endowed with reason and conscience and should act towards one another in a spirit of brotherhood (UN, 2015a:4). Measures undertaken to dismantle the superiority perspective in society are welcome as they help to build social cohesion which is vital to expedite any country's socio-economic development.

The International Convention on Civil and Political Rights (ICCPR) (1966) is a declaration that promotes the equality of all humans as well as non-discrimination of all persons before the law (SARDC, 2016:xiv). The declaration compels state parties to the convention to ensure that all citizens are treated equally before the law and are not discriminated against on the grounds of gender, location, language, ethnicity, etc, (SARDC, 2016:xiv). The convention's ultimate aim is to eradicate inequalities in all spheres of social life. The demise of gender inequalities among other discriminatory practices in society would ensure equal access by learners to primary and secondary education as well as to science and technology subjects.

The Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) (1979) seeks to combat all forms of discrimination against women in society (UN, 2014:2; Debusscher, 2015:9; UNESCO, 2012b:19). Article 05 clearly states that state parties to the convention should modify the social and cultural patterns of conduct of men and women with a view to the elimination of prejudices and customary and all other practices which are based on the idea of the inferiority and superiority of either sex (UN, 2014:2; Debusscher, 2015:9; UNESCO, 2012b:19). This means that no gender is superior or inferior to another as there is no yardstick to prove that. In fact, the superiority and inferiority perspective must be replaced by the mentality that gender does not count but one's capability when it comes to performing tasks in all spheres of social life.

The Nairobi Forward Looking Strategies for the Advancement of Women (FLS) adopted in 1985 builds on the principle of equality espoused by predecessor international conventions such as the Universal Declaration of Human Rights (UDHR) (1948), the International Convention on Civil and Political Rights (ICCPR) (1966) and the Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) (1979) (Stromquist, 2005:7; Yeba, 2015:180). The document adopted by the conference provides a blueprint for action until the year 2000 that links the promotion and maintenance of peace to the eradication of gender-based discrimination against women throughout the broad spectrum of society (Stromquist, 2005:7). It urges member states to take constitutional and legal steps to eliminate all forms of discrimination against women and tailor national strategies to facilitate the participation of women in efforts to promote peace and development (Yeba, 2015:180; Stromquist, 2005:7).

It further states that the three objectives of the decade namely equality, development and peace are broadly interrelated and mutually reinforce each other to the extent that the achievement of one contributes to the achievement of another (Stromquist, 2005:7). It is clear from the convention that the elimination of all forms of discrimination against women is a cornerstone to the promotion of peace and development in society. It is therefore, imperative to create an even playing field for both sexes so that gender neutrality in society can be realised.

Article 04 of the United Nations Convention on the Rights of the Child (CRC) (1989) commits governments to do all they can to fulfil the rights and protection of every child (United Nations Educational Scientific and Cultural Organisation (UNESCO), 2012b:19; UN, 2014:2; Ncube & Mudau, 2017:68). This is a crucial intervention to gender inequality in society that aims to safeguard the rights and protection of every child. The convention is also applicable to the education system as it guarantees every child equal access to education, including science and technology.

The United Nations Declaration on the Elimination of Violence against Women (1993) calls upon member states to eliminate traditional and customary practices affecting the health of women and girls (SARDC, 2016:xiv). By eliminating traditional or customary practices affecting the health of women and girls, the intervention hopes to curtail the marginalisation of women in society. This provides an impetus for gender inclusivity in society.

The Fourth World Conference held in 1995 resulted in the adoption of the Beijing Declaration and Platform for Action (BPFA) which was ratified by 189 member states (SARDC, 2016:38; UN, 2010:4; UNESCO, 2015:3). The declaration, which was subjected to constant reviews, calls upon member states to commit to the advancement of mainstreaming gender policies, strategies and programmes as well as reaffirming the fundamental principles of equality, development and peace which are alienable, integral and indivisible parts of universal human rights (Debusscher, 2015:20; SARDC, 2016:38; UN, 2010:4). Mainstreaming gender in policies underscores the need for governments to devise strategies to combat gender imbalances if peace and development are to be realised in society.

According to UN (2015b:34), at the beginning of the new millennium, world leaders gathered at the United Nations headquarters with a broad vision to free our fellow men, women and children from the dehumanising conditions of abject poverty and gender inequalities. That vision was a timely intervention to gender inequality in society. This is evidenced by the adoption in the year 2000 of the United Nations Millennium Development Goals (MDGs) that seek to among other objectives, promote gender equality and empower women in society by the year 2015 (Arnot & Pennel, 2008:2; UNESCO, 2012b:18-19; UN, 2015b:4; Ncube & Mudau, 2017:68). If women are empowered, they can work alongside men to uplift their societies. Therefore, the promotion of gender equality ensures that women play complementary roles to the development of their respective societies rather than viewing them as appendages of men.

The Sustainable Development Goals (SDGs) (2015-2030) which is a successor to the Millennium Development Goals (MDGs) (2000-2015) seeks to further address key challenges of poverty, inequality and violence against women and to ensure that all global citizens enjoy human rights and fundamental freedoms without discrimination (SARDC, 2016:xiv). Equality and empowerment of women have been singled out as standalone aspects because they are dedicated to achieving the emancipation of women (SARDC, 2016:xiv). The aspect of the emancipation of women in society is consistent with this study's thrust of ensuring equal access to, and performance in science and technology subjects. Thus, where there is equality in terms of access to and performance in the identified subjects, there is also empowerment which is fundamental in addressing challenges of poverty and discrimination in society.

3.6.1.2 The Sub-Saharan region

Non-discrimination is one of the commitments of the African Union Charter on the Rights and Welfare of the Child (ACRWC) which was adopted in July 1990 in Addis Ababa, Ethiopia but entered into force on 29 November 1999 (African Commission on Human and People's Rights (ACHPR), 2017:3). Article 3 of the charter entitles and guarantees every child the full rights and freedoms irrespective of the child's parents' or legal guardians' race, ethnic group, colour, sex, language, religion, political or other opinion, national and social origin, fortune, birth or other status (ACHPR, 2017:4). Article 21 commits state parties to the charter to take all appropriate measures to eliminate harmful social and cultural practices affecting the welfare, dignity, normal growth and development of the child (ACHPR, 2017:10). The aspect which should be appreciated is the normal growth and development of the child. Thus, eliminating harmful social and cultural practices is the cornerstone to safeguarding children's welfare. Therefore, in the best interest of building the future of their countries, governments cannot have a blind eye to the rampant violation of children's rights. Such rights include equal access to, and performance in all subjects offered in schools.

According to SARDC (2016:xiv), the 2013 Agenda 2063 is the 50th Anniversary Solemn Declaration of Heads of States and Governments of the African Union (AU) that acknowledges past successes and challenges with regards to gender inequality and the empowerment of women. It is a continental framework that calls for action to all segments of the African society to adhere to the principle of promoting gender equality in all spheres of social life and development (SARDC, 2016:xiv). The declaration, which is a blueprint for the socio-economic transformation of the continent over the next 50 years seeks to translate and accelerate objectives, milestones, goals, targets, actions and measures with regards to gender issues to build a prosperous and united Africa (SARDC, 2016:xiv). The AU's Agenda 2063 acknowledges that the attainment of gender equality promotes development in society. It is against this background that the continental body calls for action from all quarters to ensure the realisation of gender neutrality in all spheres of social life. The achievement of gender neutrality is regarded as a pre-requisite for building a prosperous and united society.

The 12th Ordinary Session of the African Union Summit held in Addis Ababa in 2009 declared 2010-2020 as the African Women's Decade with the theme of 'Grassroots Approach to Gender Equality and Women's Empowerment' (SARDC, 2016:xiv). The main objective is to accelerate the implementation of gender equity and women empowerment commitments made over the last decade to African women (SARDC, 2016:xiv). The summit viewed collective effort as the rallying point to society's quest to achieve gender parity. This brings to the fore the vital role that citizens in every country should play to dismantle gender imbalances and promote women empowerment to build a united and prosperous global village.

The Southern African Development Community (SADC)'s Declaration on Gender and Development (1997) and its 1998 Addendum on the Prevention and Eradication of Violence Against Women and Children called upon state parties to commit to repealing and reforming laws, amending constitutions and changing social practices that discriminate against women. SADC member states were also called upon to among other commitments, take urgent steps to prevent and deal with violence against women and children (SARDC, 2016:xv). The regional body's call for repealing and amending the constitution to achieve gender parity dovetails with the liberal feminists' legislative reforms trajectory to alter social practices that discriminate against women in society. Such measures have the potential to usher a gender sensitive environment which is vital for correcting existing social injustices.

The 2008 SADC Protocol on Gender and Development was convened to complement other global commitments on women's empowerment and gender equality (SARDC, 2016:xiv). A comprehensive protocol in gender and development was centred around facilitating gender mainstreaming into systems and institutions for the attainment of gender equality and equity (SARDC, 2016:iii).

The protocol which came into force in 2013 adopted a monitoring tool for reporting progress on the implementation of the commitments by SADC member states. The main target of the protocol is to eliminate barriers faced by women in many spheres of social life by instituting measures to ensure equal participation and representation of women and men by 2015 (SARDC, 2016:xvi). To achieve the 2015 protocol targets, state parties were directed to enshrine gender equality and equity into their constitutions and repeal all laws that discriminate on the grounds of sex or gender (SARDC, 2016:xvi). SADC has seen it necessary to adopt a monitoring tool to push for compliance in the best interest of attaining gender equality and equity in society. It was realised that putting in place a monitoring tool would ensure compliance also speed up the elimination of barriers faced by women in society.

UNESCO's (2012b:27) overall observation is that governments' slow pace on delivering on the commitments to girls' and women's marginalisation is perpetuating gender inequalities in society. This means that girls and women continue to endure marginalisation in society despite the ratification of many international, continental and regional conventions on human rights and gender issues by several countries.

3.6.2 Interventions on Gender Inequality in Education

This section discusses interventions on gender inequality in education with specific reference to developed countries and the Sub-Saharan region.

3.6.2.1 Developed countries

On education, Article 26 of the UDHR (1948) states that, everyone has the right to education (UN, 2015a:4; Yeba, 2015:180). Education shall be free, at least in the elementary and fundamental stages (Stromquist, 2001:47; UN, 2015a:4). Elementary education shall be compulsory, technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit (UN, 2015a:4). This intervention on gender inequality in education seeks to make primary and secondary education free, compulsory and accessible to all. In the vein of this study's aim, schools are therefore, called upon to make all subjects including science and technology accessible to all.

The Convention on the Elimination of Discrimination in Education (CEDE) (1960) commits the state parties to the convention to formulate, develop and apply a national policy which will promote equality of opportunity and treatment in the matter of education without discrimination based on sex, age, ethnicity, language, location, income level, etc, (UNESCO, 2012b:19). The crafting and application of a national policy to promote equality of opportunity and treatment in education would ensure fairness in terms of boys' and girls' access to, and performance in all subjects, including science and technology. The ultimate objective of eradicating gender disparities and discrimination in education is therefore, likely to be attained.

With regards to education, Article 10 of CEDAW (1979) compels state parties to the convention to take appropriate measures to eliminate all forms of discrimination against women in order to ensure their equal rights with men in the field of education (Debusscher, 2015:9; UNESCO, 2012b:19; UN, 2014:2). The convention's goal of eliminating all forms of discrimination against women in the field of education is meant to be a platform for creating an even playing ground for men and women in terms of access to, and performance in all subject areas including science and technology. The demise of patriarchal notions which impede the achievement of equality and equity between men and women is a step in the right direction as it ensures that the marginalisation of women in education is curtailed.

The CRC (1989) commits the state parties to the convention to encourage the development of different forms of education, including general and vocational education and make them available and accessible to every child both girls and boys (Arnot & Pennel, 2008:7; UNESCO, 2012b:19; Ncube & Mudau, 2017:68). In fact, Article 28 on the right to education makes it clear that every child has the right to education (Yeba, 2015:180; UNESCO, 2012b:19). Primary education must be free and secondary education must be made available to every child (UNESCO, 2012b:19). The convention states that men and women should be accorded the same opportunities if gender disparities are to be eradicated in education. Thus, the international community has the capacity to address existing gender inequalities and other injustices not only in education, but also in other spheres of social life.

Chilisa (2002), Stromquist (2005) and Subrahmanian (2005) (cited in Runhare & Vandeyar, 2012:52) note that one of the international statutes that pronounces education as a basic human right is the Nairobi Forward Looking Strategies for the Advancement of Women (FLS) adopted in 1985. The document which provides a blueprint for action until the year 2000 contains specific recommendations for greater empowerment with regards to health, education and employment (UN, 1985:1-2). With reference to education, the document presents concrete measures to overcome obstacles that are likely to hinder the principle of equal access to education as espoused in the Charter of the United Nations, UDHR (1948), CEDE (1960), CEDAW (1979) and other international conventions which advocate for the rights and status of women in society (UN, 1985:1-2). It is imperative to note that the principle of equal access to education ushers a platform for greater empowerment of women who have for a long time suffered under the jaws of patriarchy and other discriminatory practices in education. Therefore, equality in terms of access to education in all its forms, including all subjects taught in schools is a remedy to the attainment of a gender inclusive society.

The Fourth World Conference held in 1995 which resulted in the adoption of the Beijing Declaration and Platform for Action (BPFA) (1995) calls upon governments to eliminate disparities between women and men in terms of access to education and educational outcomes (Yeba, 2015:179; SARDC, 2016:38; UN, 2010:4). The declaration which is subjected to periodic reviews compels member states to ensure equal access to education and develop non-discriminatory education and training for males and females (Marinova, 2003:2; SARDC, 2016:38; UN, 2010:4). Non-discriminatory policies in education require member states to among other issues, address the under-representation of women in certain subjects offered in schools. Science and technology are some of the subjects which are perceived to be dominated by men in the field of education. Therefore, gender neutrality in these subjects entail equality in terms of access to, and performance in them.

The MDGs, adopted in 2000 articulated the elimination of gender disparities in primary and secondary education by 2015 as one of the major goals (Arnot & Pennel, 2008:2; UNESCO, 2012b:18; UN, 2015b:5; Ncube & Mudau, 2017:68). MGD 3, Target 1, directs member states to eliminate gender disparities in primary and secondary education, preferably by 2005 and in all levels of education not later than 2015 (UNESCO, 2012b:18-19; UN, 2015b:5; Moletsane & Reddy, 2011:1). The goals provide solutions to gender disparities in education. One of the solutions is to eradicate gender inequalities not only in primary and secondary education, but also in all levels of education by the stipulated time frame. The main goal is to come up with a gender balanced education system that is accessible to all. This implies that the principle of equal access should apply to all levels of education, including science and technology subjects.

Like the MDGs 2000-2015, the SDGs 2015-2030 seek to further eliminate gender disparities in education and enhance equal access in all levels of education by 2030 (SARDC, 2016:xiv). This implies that measures should be taken to further eliminate gender inequalities in education. The ultimate goal is to enhance boys' and girls' equal access in all levels of education, including all subjects taught in schools by the stipulated time frame.

In April 2000 in Dakar, Senegal, the Dakar Education for All (EFA) Framework for Action, Goal 5 of 2000, articulated that the efforts of the international community should be directed at eliminating gender disparities in primary and secondary education by 2005 and achieving gender equity in education by 2015 (Stromquist, 2006:5; Yeba, 2015:179; UNESCO, 2012b:18; Ncube & Mudau, 2017:68). According to UNESCO (2005) cited in Runhare & Vandeyar (2011:03), the achievement of EFA by 2015 is a global mission which is part of the United Nations Millennium Development Goals. This means that MDGs and EFA which aimed to achieve gender equality and universal basic education by 2015 are integral, indivisible and mutually reinforce each other in that the attainment of one contributes to the attainment of another. The international body's efforts to eliminate gender inequalities and other social injustices that are obstacles to gender parity in education should be applauded. Such a commitment is likely to usher a solution to the tracking of boys and girls into different academic fields.

3.6.2.2 The Sub-Saharan region

The African Union Charter on the Rights and Welfare of the Child (ACRWC) (1990) is a continental convention adopted during the 26th Assembly of Heads of State and Governments of the Organisation of African Unity (now African Union) in Addis Ababa, Ethiopia and entered into force on the 29th of November 1999 (ACHPR, 2017:2-3). Article 11 of the Charter stipulates that state parties should provide free and compulsory basic education and encourage the development of secondary education in its different forms and progressively make it free and accessible to all (ACHPR, 2017:5). In addition to the provision of free and compulsory basic education, the continental body calls for a gender-neutral secondary education in its different forms that is accessible to all. This can help to redress gendered education systems in some countries.

At the 2013 50th Anniversary Solemn Declaration of the Heads of States and Governments of the African Union, African leaders adopted the Agenda 2065, a continental framework that seeks to make basic education free and compulsory and secondary education free and accessible to all (SARDC, 2016:xiv). The blueprint seeks to accelerate the implementation of set targets which are set to be attained over the next 50 years (SARDC, 2016:xv). By seeking to make secondary education 'accessible' to all among other objectives, the continental body is pledging to eradicate all impediments to the attainment of a gender-neutral school culture. Thus, the elimination of all discriminatory practices ensures the realisation of gender inclusivity which is a pre-requisite to make not only education accessible to all, but also all subjects offered in schools, including science and technology.

In 1997, the SADC region adopted the SADC Declaration on Gender and Development which seeks to, among other objectives ensure that girls have equal access to education and health care (SARDC, 2016:xv). It also seeks to ensure that girls are not subjected to any treatment which causes them to develop a negative self-esteem (SARDC, 2016:xv). The declaration further calls upon state parties to enact laws that promote equal access to education and adopt gender-sensitive educational policies (SARDC, 2016:xv). The passing of bills by state parties to promote gender parity in education is in harmony with the liberal feminists' call for legislative reforms so that unfairness with regards to access to education as well as all subjects offered in schools, including science and technology can be eradicated. The adoption of gender-sensitive policies does not only boost girls' self-esteem, but also inculcates in them the notion that they are as competent as their male colleagues when it comes to performance in all subjects they study at school.

The 2008 SADC Protocol on Gender and Development which was convened to complement other global commitments on women's empowerment and gender equality called upon SADC member states to enact laws that promote equal access to and retention in primary, secondary, tertiary, vocational and non-formal education (SARDC, 2016:xvi). The convention which was a follow up to the 1997 SADC Declaration on Gender and Development compels state parties to accelerate the adoption and implementation of gender sensitive educational policies and programmes (SARDC, 2016:xvi). It is evident from the SADC Protocol that the enactment of laws is regarded as fundamental in redressing gender inequalities that have permeated many facets of social life, including education. Therefore, a gender sensitive education system is called for because it is a panacea to unfairness in terms of access to, and performance in all subjects taught in schools including science and technology.

UNESCO (2012b:21) notes that many countries around the world have made significant progress in reducing gender disparities in education but the progress has without doubt been uneven as girls in some countries continue to be outnumbered by boys in terms of access to, performance and completion of primary and secondary education. This shows that gender inequalities are still entrenched in some spheres of life such as education and occupational sectors.

3.6.3 Interventions on Gender Inequality in Mathematics, Science and Technology

This section discusses interventions on gender inequality in mathematics, science and technology with specific reference to developed countries and Sub-Saharan region.

3.6.3.1 Developed countries

Commitments on women's and girls' access to and participation in science and technology have been made by governments at the international, continental and regional levels (UN, 2010:4). Through Article 26, the UDHR (1948) underscores the need for governments to offer gender-sensitive curricula and gender-responsive education in terms of equal access to, and performance in primary and secondary education as well as all subjects offered in those levels (Stromquist, 2001:47; UNESCO, 2012b:58). To this extent, schools are expected to work towards dismantling the belief that girls are not as good as boys in science and technology subjects and create an enabling environment for equal access to and performance in those subjects. With the help of governments' gender sensitive curricula, gender responsive education in terms of equal access to and performance in science and technology is possible.

The Beijing Platform for Education (BPFA), which was adopted at the Fourth World Conference for Women in 1995 calls upon governments and all stakeholders to increase women's access to and retention in science and technology, including by adapting curricula and teaching materials and by increasing the share of women teachers in scientific and technological disciplines at all levels of education (paras. 82 (g) and 83 (f)) (SARDC, 2016:38; UN, 2010:4). This means that in addition to increasing women's access to and their retention in science and technology subjects, the stakeholders are called upon to ensure that the curricula are not gendered. Gendered school curricula tend to stereotype subjects resulting in fewer women than men pursuing science and technology subjects as well as science and technology related careers.

The twenty-third special session of the General Assembly (2000) document highlights the need to encourage and support the education of girls in science subjects, Mathematics and new technologies including information technologies and technical subjects (para. 82(i)) (UNESCO, 2012b:58; UN, 2010:4). It also stresses the importance of providing access to and control over technology, particularly for women, including those living in poverty as well as for women entrepreneurs (paras. 74(a) and 82(g)) (UN, 2010:4-5). The document which is in support of the girl child's access to, participation and performance in science subjects, Mathematics and new technologies aims to empower the previously disadvantaged gender so that men and women can work together to build their countries. Complementing each other's efforts is vital for the sustenance and development of any society.

The Science Agenda-Framework for Action of the UNESCO World Conference on Science (WCS) (1999) calls for special efforts by governments, educational institutions, scientific communities, non-governmental organisations and the civic society to ensure the full participation of women and girls in all aspects of science and technology (UN, 2010:5). The WCS also calls for the support of bilateral and international agencies to ensure that girls' and women's full participation in all aspects of science and technology is realised (UN, 2010:5). The call for full participation of women and girls in all aspects of science and technology can be the starting point to achieve gender parity. Girls' and women's full participation in science and technology subjects can break the shackles of unfairness and replace them with the notion that gender is just a social construct which cannot hinder them from excelling in those disciplines. Therefore, every learner irrespective of gender can perform well in all subjects taught in schools, including science and technology which are perceived masculine subjects.

The World Summit on the Information Society (WSIS) in the Geneva Plan of Action (2003) and the Tunis Agenda for Information Society (2005) recognises the importance of promoting women's participation in Information and Communication Technologies (ICT) as well as science and technology (UN, 2010:5). It calls upon equal access and training opportunities as well as early intervention programmes in ICT and science and technology related fields (UN, 2010:5). These should be targeted at young girls to increase the number of women in ICT as well as science and technology related careers (UN, 2010:5). The interventions which are targeting young girls to participate in ICT and science and technology disciplines are applauded since gender inequalities tend to be constructed at an early age by the family through primary socialisation. Therefore, deconstructing them at an early age may yield desired results of increasing the number of women in ICT as well as science and technology related careers. Thus, increased access to the subjects at an early age may translate to increased number of women who may choose ICT as well as science and technology related careers.

The Commission on the Status of Women (CSW) has addressed the aspect of gender participation in science and technology in several of its sessions since 1996 (Debusscher, 2015:6; UN, 2010:5). It called for renewed gender parity to be given to education in terms of girls' and women's access to Information Technology (IT), Mathematics as well as science and technology (UN, 2010:5, Debusscher, 2015:6). The importance of professional guidance to promote equal participation in these fields was stressed (Debusscher, 2015:6; UN, 2010:5). In addition to equal access to, and participation in the subjects identified above, professional guidance has been emphasised as crucial to achieve gender inclusivity. The implication is that professional guidance and advice tend to boost the girl child's self-esteem and her confidence to learn the subjects with increased zeal. A confident learner with boosted morale tends to enjoy the subjects and easily accomplish set targets.

3.6.3.2 The Sub-Saharan region

The AU Conference of African Women in Science and Technology 2007 called upon governments to support the full participation of girls and women in science and technology related fields (SARDC, 2016:39). In line with the 2007 AU Summit decision of African Heads of States and Governments, the support was viewed as a vital instrument for the advancement and empowerment of women (SARDC, 2016:39). The implication is that women need support from various stakeholders, including governments and non-governmental organisations if gender parity with regards to their participation in science and technology is to be realised. Full support is likely to translate into full participation in science and technology and if women are empowered they can contribute meaningfully to the development of their countries using acquired skills.

As a follow up the recommendations submitted to the 1995 Beijing World Conference on Women by the United Nations Commission on Science and Technology for Development (UNCSTD), all AU governments signed a declaration establishing the Gender Advisory Board (GAB) in 2005 (UN, 2011:2). Some key gender concerns identified during the convention include the promotion of gender equity in science and technology education by member states (UN, 2011:2). By addressing key gender concerns, the AU's GAB is championing the demolition of male supremacy in society in the best interest of achieving gender parity in science and technology education. The promotion of gender equity in the subjects is a welcome initiative considering the unequal power relations bedevilling the global village.

At the African Union Congress of Scientists and Policy makers held in Alexandria in 2006, all AU governments committed themselves to promoting gender parity in science, engineering and technology education (UN, 2011:1). The document adopted at the congress also provides a blueprint for action by AU governments with regards to equal access to science, engineering and technology related employment (UN, 2011:1). In view of the above, the continental body is credited for working towards dismantling the notion that women are not as good as men in science, engineering and technology subjects. This way, a gender-neutral environment where all learners have access to the subjects identified above can be realised.

The AU Summit of the Heads of State and Government adopted the Action Plan for the Implementation of the second Decade of Education for Africa (2006-2015) (UN, 2011:1). The Action Plan is laden with strategies for promoting gender parity with regards to access to, participation and performance in science and technology related fields within AU member countries (UN, 2011:1). The Action Plan which aims to eradicate gender disparities in science and technology hopes to remedy the unequal distribution of subjects in education. If the channelling of subjects according to gender is removed an even playing ground which is vital in redressing the under-representation of women in the subjects can be ensured.

Africa's Science and Technology Consolidated Plan of Action (STCPA) was spearheaded by the AU regional conference on women in science and technology in Africa to deliberate on women's increased access to science and technology fields (UN, 2011:1). It was a call for women's increased access to, and participation in science and technology disciplines (UN, 2011:1) in order to empower women.

At the 2008 SADC Protocol on Gender and Development convened to complement other international, continental and regional conventions on women's empowerment and gender equality, member states were called upon to increase the enrolment of girls alongside boys in primary schools (SARDC, 2016:iii). They were also directed to improve girls' access at secondary level as well as for the study of science and technology (SARDC, 2016:iii). It is evident that the SADC Protocol on Gender and Development is directing its effort towards gender parity in terms of enrolment at primary level, access at secondary level as well as for the study of science and technology subjects. Thus, gender sensitivity encompasses boys' and girls' equal access to, and performance in science and technology subjects among other areas of the protocol's concern.

A Charter establishing SADC Women in Society and Technology Organisation was drafted in 2015 (SARDC, 2016:38-39). Article 3 of the draft Charter provides for the operationalisation and setting up of an independent secretariat while Article 9 (ii) puts in place mechanisms for the advocacy, mentoring and mobilisation of girls and women to pursue studies and training in STEM fields (SARDC, 2016:38-39). It is evident that the Charter is advocating for the empowerment of girls and women through pursuing STEM subjects which are perceived to be male dominated disciplines. This will help to bridge the gender gap and ensure the eradication of gender inequalities in the subjects. Thus, the closure of the gender gap ensures drifting towards gender equity through remedying the under-representation of women in the disciplines identified above.

SARDC (2016:viii) notes that challenges to achieving gender equality in many spheres of life including the field of education as well as science and technology continue to be visible despite the 1979 CEDAW and other international commitments of ending gender disparities. This means that gender inequalities are still embedded in many spheres of life, including science and technology subjects.

3.7 NATIONAL INTERVENTIONS TO GENDER INEQUALITY IN ZIMBABWE

A development that provides the impetus for gender inclusivity is that Zimbabwe is a signatory to international, continental and regional bodies that aim to create and attain equity and equality between men and women (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:35; Mutekwe & Zikhali, 2012:42). These include:

- Universal Declaration of Human Rights (UDHR) (1948).
- The Convention on Civil and Political Rights (CCPR) (1966).
- The Convention on the Elimination of all forms of Discrimination Against Women (CEDAW) (1979).
- The Nairobi Forward Looking Strategies for the Advancement of Women (FLS) (1985)
- The United Nations Convention on the Rights of the Child (CRC) (1989)
- The Beijing Declaration and Platform for Action (BPFA) (1995).
- Convention on the Minimum Age of Marriage and Registration of Marriages.
- The Millennium Development Goals (MDGs) (2000).
- Education for All (EFA) (2000).
- The African Union Charter on the Rights and Welfare of the Child (ACRWC) (1990)
- Southern African Development Community (SADC)'s Declaration on Gender and Development (1997) and its addendum on the Prevention and Eradication of Violence Against women and Children (1998).
- Southern African Development Community (SADC) Ministerial Declaration of 2007 which stated that women should constitute 30% of decision-making positions by 2011. This was later revised to 50% by 2015.
- Southern African Development Community (SADC) Protocol on Gender and Development (2008).

In line with Zimbabwe's need for gender inclusivity as well as eradicating discrimination along gender lines, a number of measures were instituted by the Zimbabwe government after independence. According to SARDC (2016:35), Gudhlanga, Chirimuuta and Bhukuvhani (2012:33-36), Mutekwe and Zikhali

(2012:42) and Mutekwe and Modiba (2015:1), some of the steps taken by the government of Zimbabwe to eradicate gender imbalances include:

- Introducing the policy of universal education in 1980. Under this policy, no one was supposed to be discriminated against in terms of race, sex, ethnicity and religious affiliation among others.
- Forming the Women's Affairs Ministry at independence which was later transformed into the Ministry of Youth, Gender and Employment Creation. The ministry was tasked to eradicate gender discrimination in all sectors of the society. It focused on exploring ways to provide gender equity, mainstreaming and inclusivity in all areas of development and to make women enjoy more citizenship rights.
- Passing the Legal Age of minority Act in 1982. According to this Act men and women were for the first time legally equal. Women were no longer minors.
- Passing the Equal Pay Act in 1982. This meant that women employed to do the same job as men with the same qualifications would get equal salaries with their male counterparts.
- Adopting the National Gender Policy in 2004. The policy sought to address several critical challenges related to empowering girls and women in education, training, politics, the economy and decision making.
- The Education Act of 2006 guarantees the right to education for every child and forbids discrimination including gender.
- The 2013 constitution outlaws child marriages by striking down section 22(1) of the Marriage Act (Chapter 5:11) which allowed child marriages.
- Basic Education and Assistance Module. This was done with gender parity in mind.

According to SARDC (2016:39) the following are measures and practices put in place by the Zimbabwe government to support equal access, opportunities and participation of women and men in STEM fields:

- Ministry of Higher and Tertiary Education now merged with Science and Technology development. The Ministry has a 50-50 gender policy in terms of access, opportunities and participation in science and technology subjects.

- Free education for all learners in public schools at Advanced Level who take up science subjects starting from 2016. That is implemented with gender parity considerations. Government will pay full school and boarding fees.
- Formation of Girls Science Camps.
- Promotion of Mathematics Olympiad with gender parity in mind.
- Science exhibitions.

3.8 IMPLICATIONS OF LITERATURE REVIEW

The literature review has equipped me with an in-depth understanding of how gender socialisation affects the education of boys and girls in terms access to, and performance in science and technology subjects taught in Zimbabwean schools. It has also laid a solid foundation on the study of gender sensitivity in the teaching and learning outcomes in science and technology subjects. It enabled me to examine how gender manifests itself within the school culture. The reviewed literature also provided the theoretical framework which helped to shape the focus of the study. Furthermore, the literature review provided the basis for analysing my findings whereby the study would either reject or confirm earlier findings.

3.9 CHAPTER SUMMARY

This chapter has reviewed literature on gender sensitivity in teaching and learning outcomes in science and technology and in related aspects. The reviewed literature was informed by the funnel approach which began with the world perspective followed by the African view and finally the Zimbabwean perspective. An exploration of interventions on gender inequalities in the public sphere was followed by the government of Zimbabwe's interventions on domesticate gender imbalances. The discussion was also anchored on the premise that the more one reads research done by others on the same topic or related aspects, the better one can approach and tackle his or her own study. It was established that the problem of gender inequalities is a global phenomenon. Despite Zimbabwe's interventions to gender inequality and the fact that several countries including Zimbabwe have ratified many conventions on human rights and gender issues, it is regrettable that girls and women continue to endure marginalisation in many spheres of life such as education and occupational sectors.

The family is blamed for constructing gender disparities via the socialisation process which starts from an early age. Thereafter, gender bias infiltrates into the other social institutions like religion, education, politics and the economy. These social institutions have been accused of being gender biased as evidenced by gender imbalances bedevilling societies globally.

CHAPTER FOUR

RESEARCH PARADIGM, DESIGN AND METHODOLOGY

4.1 CHAPTER INTRODUCTION

This chapter discusses the research methodology employed in this study which covers. The research paradigm, design and methodology used in the study with regards to the nature of boys' and girls' access to and performance in science and technology subjects in schools. The chapter discusses the different types of research paradigms, designs and methodologies that are available for research purposes and adopts those that are relevant for this study with justifications. The chapter also discusses population sampling, data collection and data analysis. The last part of the chapter dwells on measures to be taken to provide validity and reliability in quantitative research as well as trustworthiness in qualitative research. The three types of research paradigms are explored in detail below.

4.2 RESEARCH PARADIGMS

A paradigm is a research culture with a set of beliefs, values and assumptions that a community of researchers has in common regarding the nature and conduct of research (Antwi & Hamza, 2015:218). Bunnis and Kelly (2010:359) define a paradigm as a set of basic beliefs and practices which are shared by communities to regulate inquiry within disciplines. Monette, Sullivan, DeJong and Hilton (2014:38) view paradigms as general ways of thinking about how the world works and how people gain knowledge about the world. The above definitions dovetail with that of Neuman (2011:94) who describes a paradigm as a whole system of thinking.

These definitions are consistent with that of Creswell (2009:6) who views a paradigm as simply "a worldview". From these definitions, a paradigm can be regarded as the worldview or traditions shaping research.

4.2.1 The Positivist Paradigm

The positivist paradigm which is also referred to as the scientific paradigm due to its application of the natural sciences methods on the practices of social sciences emphasises observation and reason as means of understanding the social world (Denscombe, 2008:14). According to Neuman (2006:82) positivists believe in the existence of objective reality outside personal experiences and that a positivist researcher adopts a distant, detached and non-interactive position. Thus, genuine knowledge according to positivists is based on sense experience and can only be advanced by means of observation and experiment. Morris (2006:3) asserts that what would be seen as knowledge produced on the basis of direct observation by the senses should be measured and recorded.

The ontological position of positivism is realism, which views social reality as external to the researcher (Livesey, 2011:1). Ontology, according to McGregor and Murnane (2010:421), is concerned with what counts as nature, reality, feeling, existence or being. Crotty (2003:10) specifies that ontology regards the nature of existence. In the same vein, Denzin and Lincoln (2000:18) views ontology as a philosophical study that specifies the nature of reality to be studied. Punch (2005:18) posits that objects exist independently and have no dependence to the knower or researcher. Pring (2008:58) gives a similar view by stating that there is reality, a world which exists independently of the researcher (knower) and which is to be discovered. The above scholars draw a clear distinction between the knower and the subject to be known. In this study, the ontological position is that reality exists independently of me, the researcher.

Thus, by analysing school documents namely; 2016 and 2017 ‘O’ and ‘A’ Level results at a mixed sex and a single sex school (Appendix 4) to establish if there was any significant difference in terms of boys’ and girls’ performance in science and technology subjects, I discovered objective reality while taking a detached position outside my personal experiences. Even during the administration of questionnaires (Appendix 6) to learners to explore the nature of boys’ and girls’ access to and performance in science and technology subjects at school, I adopted an objective stance with less interaction with subjects of the study to gather real knowledge.

Epistemologically, positivists hold an objectivist view of the world in which the knower and the subject to be known are independent entities (Antwi & Hamza, 2015:219). According to Denzin and Lincoln (2000:18), epistemology refers to the process in which the investigator comes to know the truth and reality. Krauss (2005:759) defines the term epistemology as the philosophy of knowledge or how people come to know. Morgan (2007:53) views epistemology as the science of knowing. It deals with the nature of knowledge and the relationship between the knower and the known (Grix, 2004:58). McGregor and Murnane (2010:421) posit that epistemology is concerned with what is deemed worthy and how people come to know it. According to Livesey (2011:1), positivists approach the world impartially, discovering absolute knowledge about an objective reality. Neither the knower nor the subject to be known exerts influence on the other and meaning resides in the objects, not the conscience of the researcher and it is the aim of the researcher to obtain meaning (Morris, 2006:3). In this study, I discovered genuine knowledge impartially by analysing the 2016 and the 2017 ‘O’ and ‘A’ Level results to establish if there was any significant difference in terms of boys’ and girls’ performance in science and technology subjects at a single sex and a mixed sex school (Appendix 4). Analysis of these documents enabled me to discover absolute knowledge without influence from the study subjects during the analysis process. Thus, I took a distant and non-interactive position during document analysis.

Questionnaires (Appendix 6) also gathered genuine knowledge in terms of access to and performance in science and technology subjects by boys and girls in a single sex and a mixed sex school because I did not exert any influence on the learners who were filling them in. I took an impartial position during questionnaire administration to forms one to six learners at a single sex and a mixed sex school.

Quantitative research is underpinned by the positivist methodology (MacDonald & Headlam, 2012:51). Methodology refers to the strategy or plan of action which lies behind the choice and use of particular research methods (Scotland, 2012:9). Polit and Hungler (2004:233) define methodology as ways of obtaining, organising and analysing data. It includes the design, sample and data collection as well as analysis techniques in a study (Burns & Grove, 2003:488). Henning 2004:36) describes methodology as a coherent group of methods that complement one another and that have the ability to deliver data and findings that will reflect the research question and suit the researchers' purpose. Positivist methodology includes experimental design to explain the cause and effect of tenets (Creswell, 2008:153). Questions and hypothesis are tested and verified by experiments (MacDonald & Headlam, 2012:51). Kothari (2004:110) posits that numerical data that can be generated, tabulated and analysed statistically can be obtained through questionnaires, observation and study of public documents. This study used the questionnaire as the data collection approach. In order to gather quantifiable data, I administered questionnaires (Appendix 6), to forms one to six learners at a single sex school and another group of form 1-6 learners at a mixed sex school. The idea was to establish if there was any significant difference in terms of access to and performance in science and technology subjects by boys and girls at the two schools. I also generated quantifiable data using the document analysis protocol (Appendix 4) by analysing the 2016 to 2017 'O' and 'A' Level results to establish if there was any significant difference in terms of boys' and girls' performance in science and technology subjects at a single sex and a mixed sex school.

4.2.2 The Interpretivist Paradigm in Research

The interpretivist paradigm, which is also referred to as the anti-positivism paradigm argues that positivism is not the only way to see the world (McGregor & Murnane, 2010:422). This point of view dovetails with that of Creswell (2009:7) who asserts that interpretivist researchers believe in multiple perspectives from participants rather than a single reality. Livesey (2011:4) views interpretivism as a method that sees the social world as something that can only be produced and reproduced on a daily basis by people. Cohen, Manion and Morrison (2003:21) present the distinguishing features of the interpretive paradigm as follows: interpretivists state that reality is multi-layered and complex. They believe that people are creative and actively construct their social reality. They further note that the social world should be studied in the natural world through the eyes of the participants, without the intervention of the researcher. This implies that a single phenomenon is subject to diverse interpretations.

The ontological position of interpretivism is relativism which is the view that reality is socially constructed, subjective and differs from one person to another (McGregor & Murnane, 2010:421). Livesey (2011:4) points out that, through conscious engagement with objects, reality emerges. Consistent with the above scholars' points of view, Creswell (2009:14) posits that reality is individually constructed and there are as many realities as there are individuals. This implies that interpretive researchers believe in multiple realities. In this study, the interview approach of generating data was used to solicit many realities from heads of schools, their deputies, science and technology subjects Heads of Departments (HODs), science and technology subjects class teachers and science and technology subject teachers about how society promotes gender inequalities in the teaching and learning of subjects identified above (Appendix 7).

Epistemologically, interpretivists adhere to a subjective worldview as they believe that reality consists of people's subjective experiences of the external world (Antwi & Hamza, 2015:218). Babbie and Mouton (2008:28) state that interpretivists assume that knowledge and meanings are acts of interpretation, hence there is no objective knowledge which is independent of human reasoning. In the same vein, Crotty (2003:10) notes that epistemologically the interpretive paradigm is underpinned by observation and interpretation. In light of the above, it can be concluded that the relationship between the knower and the subject to be known is not of detachment but rather involvement through interaction of individuals. In this study, I used interview schedules (Appendix 7) to conduct face-to-face semi-structured interviews with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers at a single sex and a mixed sex school. The purpose was to get a fuller and deeper understanding of how society affects boys' and girls' access to and their performance in science and technology subjects in schools. Thus, the issue of factors that promote gender imbalances in science and technology subjects in schools entailed interaction between me and the above-named study participants.

Interpretivists employ methodologies that enable them to understand the world as it is from subjective experiences of individuals (Antwi & Hamza, 2015:218). The researcher should become part and parcel of the participants in order to understand

and feel what they experience. Shaningwa (2007:30) indicates that the interpretivist paradigm allows the researcher to understand the situation or the phenomena being studied and to interpret meanings within the social or cultural contexts of the participants. Thus, interpretivists use meaning oriented methodologies. In this study, I used the interview schedules (Appendix 7) to conduct, face-to-face semi-structured interviews to heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers at a single sex and a mixed sex school.

The interview processes gave me room to probe deeper and uncover more information and explanations on factors that influence the difference in performance of boys and girls in science and technology subjects.

4.2.3 The Critical Paradigm

According to Van Dijk (2008:85), the critical paradigm subscribes to the view that that research is conducted for groups in an egalitarian society. The scholar identifies two important tenets of the paradigm. Firstly, reality is historically constituted and that it is produced and reproduced by people. Secondly, people are constrained by various forms of social, cultural and political domination in their effort to change their social and economic circumstances. Creswell (2009:9) observed that, as researchers and participants are involved in the research process, the emancipatory worldview needs to be intertwined with politics and political agenda. Thus, critical researchers have the duty to encourage people's emancipatory consciousness so that open criticism can help to question the *status quo* and bring about cultural, political and social change (Van Dijk, 2008:85).

Ontologically, reality in the critical research paradigm is described within a political, cultural, historical and economic context (Creswell, 2009:9). Mertens (2008:74) states that the transformative-emancipatory ontology holds that there is diversity of viewpoints with regard to social realities and that these viewpoints need to be placed within political, cultural, historical and economic value system in order to understand the basis for the differences.

The epistemological position of this paradigm, according to Mertens (2008:99) is that critical researchers should emphasise the importance of the interactive relationship between the researcher and the participants as well as the impact of social, political, cultural and historical factors that influence them. The interaction between the researchers and the participants is essential and requires a level of trust and understanding to accurately represent viewpoints of all groups.

Creswell (2009:9) points out that the critical paradigm's methodology involves researchers and participants in the research process. Van Dijk (2008:85) posits that the critical paradigm is more of an action research that offers individuals an opportunity to liberate themselves; hence the need for collaboration when using data collection methods that best serve the critical inquiry. Mertens (2008:99) argues that critical researchers may use methodologies from both the positivist and the interpretivist paradigms but should be aware of the underlying contextual, historical and political factors inherent in the subject under interrogation. The scholar states that critical researchers should use methodologies that best work and serve their critical inquiry from cultural, economic, political and historical perspectives. Focus group interviews, open-ended interviews, participant observation, analysis of journals, surveys and questionnaires are some of the data collection approaches which researchers can employ to generate information.

As espoused by Mertens (2008:99) I used both quantitative and qualitative methodologies to gather data on the nature of access to and performance in science and technology subjects by boys and girls at a single sex and a mixed sex school. The purpose was to uncover gender inequalities in science and technology education in schools so that strategies to close the gender gap can be devised. I self-administered questionnaires to gather quantifiable data (Appendix 6) from form 1-6 learners at a single sex and a mixed sex school to examine how gender socialisation affect the education of boys and girls in science and technology subjects at a single sex and a mixed sex school.

I also generated quantifiable data using the document analysis protocol (Appendix 4) to analyse the 2016 to 2017 'O' and 'A' Level results to establish if there was any significant difference in terms of boys' and girls' performance in science and technology subjects at a single sex and a mixed sex school. Again, I used interview schedules (Appendix 7) to solicit qualitative data from heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers at a single sex and a mixed sex school. The interview process enabled me to gather data on how society, through socialisation promotes gender inequalities in the teaching and learning of subjects identified above.

4.2.4 The Pragmatic Paradigm

According to Johnson, Onwuegbuzie and Turner (2007:125-126), many scholars have argued for some version of pragmatism as the most useful philosophy to support mixed methods research design due to its gains at different stages. The scholars observe that the positivist and interpretivist paradigms can remain separate but once integrated can reflect a mixed worldview and create new perspectives. In the same vein, Krauss (2005:758) notes that the complementarity of positivism and interpretivism creates a middle ground called pragmatism which integrates multiple realities or perceptions in a single study. Similarly, Morgan (2007:48) describes the pragmatism paradigm as a new paradigm in social science research which combines elements from both positivism and interpretivism into one middle ground. From the above perspectives, pragmatism can be described as a research paradigm that merges positivism and interpretivism research paradigms in a single study. Johnson, Onwuegbuzie and Turner (2007:125) point out that the pragmatic sphere enables researchers to compare results from diverse paradigms or perspectives.

Morgan (2007:71) gives the following tenets of the pragmatic sphere: positivism and interpretivism are used simultaneously in a single study. The connection of theory and data is neither deduction as in positivism nor induction as in interpretivism but abduction. The scholar emphasises that abductive reasoning that is connected to the pragmatic approach converts observation into theories and then assesses these theories through action. Thus, abductive reasoning moves back and forth between induction and deduction. In other words, pragmatism rejects a situation in which positivists pay more attention to hypotheses that interpretivists generate. On the other hand, it rejects a situation in which interpretivists pay more attention to exploring the range of phenomena that positivists seek to define and test.

Rather than each paradigm dismissing the other's work as based on wholly incompatible assumptions, the pragmatism's goal is to search for useful points of connection. Morgan (2007:71) emphasises the need for practising researchers to work back and forth between objectivity and subjectivity towards inter-subjectivity. This is important in that the inter-subjective approach captures duality which ensures a sufficient degree of understanding of the subject of study. Central to the pragmatic approach is the process of communication, shared meaning and connection.

4.2.5 The Paradigm Guiding this Study

The pragmatic paradigm is the most relevant research paradigm for this study because it combines elements of positivism and interpretivism in a single study (Morgan, 2007:48). The positivist and interpetivist paradigms in this study were used together with the critical paradigm that aims to dismantle patriarchy and bring about social justice through renegotiating male-female social roles (Asghar, 2013:23). This study's main objective dovetails with the critical paradigm's aim, hence its relevance for the study.

Therefore, it was deemed appropriate in this study to merge the three paradigms. This study was informed by the positivist paradigm in that questionnaires (Appendix 6) administered to form 1-6 learners at a single sex school and a mixed sex school sought to explore the nature of access to and performance in science and technology subjects at a single sex and a mixed sex school by boys and girls. The study was also underpinned by the interpretivist paradigm in that it sought people's views (Appendix 7) on how society through gender socialisation could influence boys' and girls' access to and performance in science and technology subjects.

I used the pragmatic paradigm in this study because it has the following advantages as espoused by Johnson, Onwuegbuzie and Turner (2007:126): firstly, it includes a wide range of theorists that a researcher can consider and make use of. Secondly, making use of diverse paradigms helps the researcher to come up with solid conclusions. Thirdly, 'legitimation' which is the ability of a paradigm to reflect a mixed worldview is another significant merit of the pragmatic paradigm.

Using this paradigm, I gathered quantifiable data by analysing the 2016 to 2017 'O' and 'A' Level results (Appendix 4) to establish if there was any significant difference in terms of boys' and girls' access to and their performance in science and technology subjects at a single sex and a mixed sex school. Using questionnaire guides (Appendix 6), I obtained quantitative data by personally administering them to a large group of form 1-6 learners at a single sex school and another group of form 1-6 learners at a mixed sex school to find out if there was any significant difference in terms of boys' and girls' access to and performance in science and technology subjects. I generated qualitative data by using the interview schedules (Appendix 7) to conduct face-to-face and individual semi-structured interviews with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers at a single sex and a mixed sex school.

The interviews enabled me to compile thick detailed and rich descriptions of the participants' views and experiences on how society, through gender socialisation influence boys' and girls' access to and their performance in science and technology subjects.

I used the pragmatic paradigm because knowledge cannot be one sided. For instance, knowledge cannot be produced through calculations only but calculations can be unpacked by narratives. Therefore, the way both positivists and interpretivists handle knowledge have a place in my study. The administration of questionnaires to learners (Appendix 6), the analysis of 'O' and 'A' Level results (Appendix 4) as well as interviews with teachers (Appendix 7) enabled me to blend and complement knowledge, thereby benefiting from both paradigms. The pragmatic paradigm gave me room to corroborate results and come up with rich data (Hesse-Biber, 2010:3).

4.3 RESEARCH DESIGN

Research designs are categorised according to research paradigms which they fall under. There are three types of research designs available for research. These are: the quantitative research design which is used by the positivists and the qualitative research design which is used by both the interpretivists and the critical paradigm researchers (McGregor & Murnane, 2010:419). The mixed methods research design which occupies the middle ground is the third type (Johnson, Onwuegbuzie & Turner, 2007:125).

According to Kumar (2005:84), a research design is a plan, structure and strategy of investigation so conceived as to obtain answers to research questions and problems. Kothari (2004:31) views a research design as the conceptual structure within which research is conducted; it constitutes the blueprint for the collection, measurement and analysis of data.

These definitions are similar to that of Babbie and Mouton (2008:74) who describe the research design as a plan, or blueprint according to which research is undertaken. From the above definitions, a research design simply refers to the plan for a study undertaken by the researcher.

4.3.1 The Quantitative Research Design

The quantitative research design which is rooted in the positivist paradigm is concerned with statistical methods and large samples, often randomly sampled (Delport & De Vos, 2011:65). It is based on the measurement of quantity or amount and is applicable to phenomena that can be expressed in terms of quantity (Kothari, 2004:3). Ramlo and Newman (2011:179) note that the quantitative research design involves more of mathematical calculations, numerical representations of data and testing of hypothesis. A similar view is given by Golafshani (2003:598) who describes the quantitative research design as essentially employing experimental methods and quantitative measures to test hypothetical generalisations. The scholar observes that the information is in numbers that can be quantified, and the final result is expressed in statistical terminologies. In view of the above, it can be concluded that the quantitative research design is appropriate to phenomena that is quantifiable. In this study, I generated quantifiable data by administering questionnaires (Appendix 6) to form 1-6 learners at a single sex school and a mixed sex school to explore how society promotes gender disparities in the teaching and learning of science and technology subjects at school.

I analysed the 2016 and 2017 ‘O’ and ‘A’ Level results (Appendix 4) at the two schools to ascertain whether there was any significant difference in boys’ and girls’ performance in science and technology subjects.

4.3.2 The Qualitative Research Design

According to Golafshani (2003:600), qualitative research design that is informed by the interpretivist paradigm uses a naturalistic approach that seeks to understand phenomena in context settings by illuminating, understanding and exploring situations. This view dovetails with that of Ramlo and Newman (2011:177) who assert that qualitative research design focuses on rich description and the meaning of phenomena based on perspectives of whoever is under examination. Similarly, Willis (2007:40) posits that qualitative research design tends to be rich with quotations, descriptions and narrations as researchers attempt to capture conversations, experiences, perspectives, voices and meanings during research. Thus, a qualitative research design can be regarded as a research design that is concerned primarily with understanding the world from the subjective experiences of individuals. Participants’ world is discovered as a result of the researcher’s interaction with them. In this study, the qualitative research design allowed me to adopt a person-centred and holistic perspective as I immersed myself into the experiences of heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers (Appendix 7) with regards to factors that promote gender inequalities in the teaching and learning of science and technology subjects.

4.3.3 The Mixed Methods Research Design

The mixed methods research design is a class of research where the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or language into a single study (Johnson & Onwuegbuzie, 2004:17). Ramlo and Newman (2011:176) define mixed methods research design as essentially the combination of qualitative and quantitative research. Their definitions are consistent with that of Creswell (2009:204) who posits that mixed methods research design focuses on combining both quantitative and qualitative research designs in a single study. Similarly, Johnson, Onwuegbuzie and Turner (2007:119) aver that mixed methods research is a systematic integration of quantitative and qualitative research designs in a single study for purposes of obtaining a fuller picture and deeper understanding of a phenomenon. This implies that mixed methods research design integrates and merges quantitative and qualitative research designs in a single study. In this study, I combined quantitative and qualitative research designs in a single study because analysing data from the two research designs concurrently enabled me to validate and corroborate the findings (Hesse-Biber, 2010:3). I generated quantifiable data by administering questionnaires to form 1-6 learners (Appendix 6) at a single sex and a mixed sex school. I analysed the 2016-2917 ‘O’ and ‘A’ Level results (Appendix 4) to ascertain whether there was any significant difference in boys’ and girls’ performance in science and technology subjects at a mixed sex and a single sex school. I generated qualitative data by interviewing (Appendix 7) heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers with regards to the extent to which gender socialisation influences boys’ and girls’ access to and their performance in science and technology subjects at school.

4.3.4 Mixed Research Design for this Study

For this study, I used the mixed methods research design which, according to Creswell (2009:204), entails combining both quantitative and qualitative research designs in a single study. I deemed it suitable to use the quantitative research design because it enabled me to gather and analyse quantifiable data. Such data included the administration of questionnaires (Appendix 6) to forms one to six learners at a single sex school and a mixed sex school to establish if there was any significant difference on access to and performance in science and technology subjects between boys and girls in a mixed sex school as well as learners in a mixed sex school with girls in a single sex school. I analysed the 2016 and 2017 ‘O’ and ‘A’ Level results (Appendix 4) at the two schools to find out if there was any significant difference in boys’ and girls’ performance in science and technology subjects.

Qualitative research design allowed me to understand the gender issue from the subjective experiences of heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers with regards to the nature of boys’ and girls’ access to and their performance in science and technology subjects at school (Appendix 7). In addition, it enabled me to adopt a person-centred and holistic perspective as I immersed myself into the participants’ experiences with regards to factors that influence the difference in performance of boys and girls in science and technology subjects (Onwuegbuzie & Leech, 2006:482). Therefore, integrating and merging quantitative and qualitative research methods in a single study enabled me to explore and interpret issues that were not quantifiable such as anxiety, attitudes, beliefs and non-verbal responses such as gestures (Willis, 2007:40). Thus, the mixed methods research design enabled me to corroborate results from different methods as well as enhance complementarily and expansion of results from diverse methods in order to develop richer data (Hesse-Biber, 2010:3).

Other advantages of the mixed methods research design as espoused by Hesse-Biber (2010:3) are that, mixed methods research increases the number of participants in one’s study to arrive at a more generalisable and comprehensive data than in an unmerged design. This is because in an unmerged research design or a single research design such as in the quantitative or qualitative alone, it is difficult for the study to give reliable and valid conclusions or generalisations since each research design has its own shortcomings. Therefore, a mixed methods research design complements the inadequacy of the quantitative method by using the qualitative one. Another advantage of the mixed methods research design is that it maximises the appropriateness and use of data gathering instruments in each study.

Thus, the use of many instruments such as questionnaire guides (Appendix 6), document analysis protocols (Appendix 4) and interview schedules (Appendices 7) can affirm the results of the findings if the instruments are carefully selected, designed and used in the appropriate ways. A third advantage is that the mixed methods research design enhances the trustworthiness of interventions or programme to re-frame research questions. Fourthly, the mixed methods research design maximises answers to the research questions, thereby triangulating and analysing both quantitative and qualitative data concurrently to validate or corroborate the findings.

4.3.5 The Convergent Parallel Design

A convergent parallel research design entails that the researcher concurrently conducts the quantitative and qualitative elements in the same study, treats the elements independently but interprets the results together (Demir & Pismeck, 2018:123). Sweeney (2016:iii) posits that, in a convergent parallel research design the researcher need to conduct the quantitative and qualitative elements of the study separately and converge them during data interpretation. Creswell (2013:2) is of the view that researchers undertaking a convergent parallel research design need to treat the quantitative and qualitative elements such as samples and sample sizes differently and triangulate them only when interpreting the two data sets. In this study, I employed the convergent parallel research design in order to identify points of concurrence and departure between the two data sets during the discussion of findings.

4.4 RESEARCH METHODOLOGY

Research methodologies are grouped according to the research paradigms and research designs which they fall under. The different types of research methodologies used in research are discussed in this section.

Methodology is described as a coherent group of methods that complement one another and have the ability to deliver data and findings that will reflect the research question and suit the researcher’s purpose (Henning, 2004:36). Holloway (2005:293) views methodology as a framework of theories and principles on which research methods and procedures are based. It entails design strategies and traditions of enquiry or research approaches used to study an issue (McMillan & Schumacher, 2001:14). Kothari (2004:8) defines research methodology as a way to systematically solve the research problem using research instruments. Similarly, McGregor and Murnane (2010:420) posit that research methodology refers to empirical, interpretive and critical ways of conducting research. MacDonald and Headlam (2012:11) also define methodology as methods of collecting primary data. Burns and Grove (2003:488) view methodology as data collection, organisation and analysis techniques. Consistent with the above definitions is that of Polit and Hungler (2004:233) who refer to methodology as ways of obtaining, organising and analysing data. In view of the above definitions, methodology refers to data collection approaches which include the population, sampling, instruments and data analysis.

There are quantitative research methodologies which are rooted in experiments as well as qualitative research methodologies which fall under the qualitative design case studies (McGregor & Murnane, 2010:420). This study which falls under the mixed methods research design employed quantitative and qualitative research methodologies simultaneously.

4.4.1 Quantitative Surveys

According to Mathers, Fox and Hunn (2009:5), surveys are a traditional way of conducting research and are useful for experimental descriptive designs that seek to unearth objective reality. Check and Schutt (2012:160) define a survey as a collection of information from a sample of individuals through their responses to questions. The above definitions are in harmony with that of Ponto (2015:169) who describes the survey research as a collection of information from a sample of individuals using quantitative research approaches such as questionnaires. The scholar states that questionnaires may be self-administered or administered on behalf of the researcher. They may also be administered to individuals separately, to a large group of participants or by post. It is clear from the definitions above that the quantitative design survey involves the administration of questionnaires using the questionnaire schedule to gather data. In this study, questionnaire schedules (Appendix 6) were self-administered to two large groups of form 1-6 learners, one at a single sex school and another at a mixed sex school. I wanted to find out if there was any significant difference on access to and performance in science and technology subjects between boys and girls in a mixed sex school as well as learners in a mixed sex school with girls in a single sex school.

4.4.2 Qualitative Case Studies

The case study is an empirical enquiry that investigates a contemporary phenomenon within its real-life context and in which multiple sources of evidence are used (Creswell, 2010:75). Similarly, Yin (2003:13) defines the case study as an empirical enquiry that investigates phenomena, within its real-life context, especially when the boundaries between phenomena and context are not clearly evident. In the same vein, Maree (2011:75) states that the case study investigates a contemporary phenomenon by using selected cases for an in-depth investigation of the issue under study.

The above views dovetail with that of Gillham (2000:1) who defines a case study as an investigation to answer specific research questions which seek a range of different evidences from the case settings. Welman, Kruger and Mitcheli (2005:193) view a case study as a number of units of analysis such as an individual, a group or an institution that is studied intensively. Their definitions are consistent with that of McMillan and Schumacher (2010:24) who note that the case study is an empirical enquiry in which the researcher gathers information through documentary review, focus group interviews and in-depth-face-to-face semi-structured interviews. These imply the adoption of a person centred and holistic perspective in which the researcher is immersed in the phenomenon under study as an important attribute of case studies.

Berg (2001:225) claims that the case study is not actually a data gathering technique, but a methodological approach that incorporates a number data of gathering measures. These include life histories, documents, oral history, in-depth interviews, focus groups, questionnaires, archives, group interviews, personal biographical, ethnographies and participant observation. Out of the data gathering instruments identified above, I made use of documentary analysis (Appendix 4) and in-depth interviews (Appendix 7) at the two case study sites which are a single sex and a mixed sex school.

The selection of a relevant type of case study method is crucial if an in-depth study of participants is to be achieved. Scholars suggest certain types of case studies which include intrinsic, instrumental and collective (Denzin & Lincoln, 2005:445; Berg, 2001:225). According to Berg (2001:225), the intrinsic case study has a disadvantage in that it only focuses on studying one particular or unique case and does not seek to answer any research questions as well as relate or compare the case with any other cases. Owing to this disadvantage, I found it inappropriate for this study.

Although an instrumental case study can be guided by some research questions, it focuses on understanding a single issue or phenomenon based on studying a single case (Denzin & Lincoln, 2005:445). For that reason, I did not use it in my study which comprised of two case study sites with relevant sub-cases or participants who had first-hand information on the factors that could influence boys' and girls' access to and performance in science and technology subjects at a mixed sex and a single sex school. I therefore, settled for the collective case study which, according to Hamilton & Corbett-Whittier (2013:15), is an intensive study of two or several cases within a bounded setting. The aim was to create a deep or broad understanding on the nature of boys' and girls' access to and their performance in science and technology subjects at a single sex and a mixed sex school through interviews (Appendices 4, 6 & 7).

4.4.3 Research Methodology Guiding this Study

For this study, mixed methods research methodology that merges the quantitative and qualitative data collection approaches in a single study was employed. I self-administered questionnaires (Appendix 6) to two large groups of forms one to six learners, one at a single sex school and another at a mixed sex school. This enabled me to collect quantifiable data on the nature of boys' and girls' access to and performance in science and technology subjects at a mixed sex and a single sex school. I analysed the 2016 and 2017 'O' and 'A' Level results (Appendices 4) to ascertain if there was any significant difference in terms of performance in science and technology subjects between boys and girls at the single sex and mixed sex schools. Science subjects which were considered for access and performance are Mathematics, Physics and Chemistry and technology related subject areas chosen were Technical Graphics, Agriculture, Metal Work, Wood Work and Building. The subjects were selected on the basis that they are traditionally stereotyped as masculine (Mutekwe & Modiba, 2012:280).

To obtain qualitative data in the same study, I interviewed (Appendix 7) heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers, science and technology subject teachers at a single sex school and a mixed sex school to explore how society promotes gender disparities in the teaching and learning of science and technology subjects. Through in-depth face-to-face individual semi-structured interviews, I was able to immerse myself in the participants' naturalistic environment, that is, at their own schools enabled me to probe, prod and cajole to solicit information with regards to gender imbalances in the teaching and learning of science and technology related subjects in single sex and mixed sex schools. Furthermore, interviewing teachers within their natural contexts facilitated the collection of thick, detailed and rich data on the named participants' experiences and views with regards to the nature of boys' and girls' access to and their performance in science and technology subjects.

It is important to point out that while quantitative data was objective and relied on sense experience, qualitative data was subjective and sought to understand phenomena in context or the real world setting with regards to how society promotes gender inequalities in the teaching and learning of science and technology subjects in schools (MacDonald & Headlam, 2012:9; Antwi & Hamza, 2015:222). Combining quantitative and qualitative data collection approaches in one study enabled me to corroborate results from different angles, thereby enhancing expansion of findings to develop richer data (Hesse-Biber, 2010:3).

A detailed discussion on the integrated quantitative and qualitative methodologies employed in this study is given in subsequent sections under their respective sub-headings.

4.5 STUDY POPULATION

Population is one of the sources of information from which a sample for data collection is drawn. Methodologies, which are data collection approaches such as interviews and questionnaires are used on a population sample to generate results (McMillan & Schumacher, 2001:489). Methodologies inform the study population, study samples, instruments and data analysis.

Population as viewed by Kothari (2004:153) is the total number of items about which information is desired. It is generally a large collection of individuals or objects which is the main focus of scientific query (Castillo, 2009:21). McMillan and Schumacher (2001:489) define population as a group of individuals or events from which a sample is drawn and to which results can be generated. Similarly, MacDonald and Headlam (2012:12), posit that the word population is used to describe the target group from which study results can be obtained. Therefore, population includes all elements that meet certain criteria for inclusion in a study.

4.5.1 Population Size

In this study, the group which was of interest to me were learners, heads of schools, deputy heads, science subjects HODs, technology subjects HODs, science subjects class teachers, technology subjects class teachers, science subject teachers and technology subject teachers from a single sex and a mixed sex school in Zimbabwe. Altogether the population for this study from the two study sites comprised of 1 949 participants. This target population from which a sample was drawn adequately covered the scope of the study. The population size that was targeted for this study is tabulated below.

Table 4.1: Population Size Per Study Site

Participants	Single Sex School	Mixed Sex School	Total
Heads of Schools	1	1	2
Deputy Heads	1	1	2
Science Subjects HODs	1	1	2
Technology Subjects HODs	1	1	2
Science Subjects Class Teachers	8	9	17
Technology Subjects Class Teachers	2	2	4
Science Subject Teachers	5	5	10
Technology Subject Teachers	2	3	5
Form One Learners	160	217	377
Form Two Learners	157	220	377
Form Three Learners	151	236	387
Form Four Learners	129	168	297
Form Five Learners	118	142	260
Form Six Learners	91	116	207
Total	**827**	**1122**	**1949**

4.5.2 Sampling Procedure in Mixed Methods Studies

According to Alvi (2016:11) the process through which a sample is extracted from a population is referred to as the sampling procedure. Ponto (2015:170) notes that the goal of sampling in research is to obtain a sufficient sample representative of the population of interest. Thus researchers must ensure that the samples which they draw for their studies adequately represent the target population. This study employed probability sampling which is rooted in the quantitative research design and non-probability sampling which is underpinned by the qualitative research design separately to come up with a sample for this study.

4.5.2.1 Quantitative sampling procedure for the study

Probability sampling is a sampling procedure that bids a basis for opinion of probability that elements in the universe will have an equal chance to be included in the study sample (Etikan & Bala, 2017:149). Alvi (2016:13) posits that in probability sampling procedure every member of the population has a known or non-zero probability of being included in the sample. MacDonald and Headlam (2012:68) view probability sampling as a sample of a population where each member of the population has an equal chance of being in the sample. Probability sampling is also referred to as random sampling, chance or representative sampling in that some form of random selection on a very precisely defined population which is not too general is used (Etikan & Bala, 2017:149; Alvi, 2016:13; MacDonald & Headlam, 2012:68). The above authors concur that the use of clearly and specifically defined population minimises the chance of sampling biases and enhances the chance of coming up with a better representative sample. In this study, all learners at a single sex school and a mixed sex school who constituted the population for the study were sampled and served with questionnaires which they completed and returned. Details with regards to the actual sampling procedure are discussed later in this section.

According to Kothari (2004:62), Alvi (2016:17), Etikan and Bala (2017:150) there are basically five types of probability sampling and these are: simple random sampling, systematic random sampling, stratified random sampling, cluster sampling and multi-stage sampling.

4.5.2.1.1.1 Simple random sampling

Simple random sampling, according to Etikan and Bala (2017:150-151) ensures that every element of the population has an equal chance of being selected in a sample. According to Kothari (2004:62), the elements must not have any overlapping characteristics, but should be homogeneous with the same characteristics that meet the described criteria of the target population. Before taking a sample, the population needs to be defined and the list of all the elements of the population is required (Alvi, 2016:17). The lottery was suggested as one of the methods of selecting participants in which each element is first given a number and then numbers are individually written on slips of paper. The slips are put and mixed thoroughly in some bag or bowl. The decided number of slips is drawn out of it. I used this type of sampling in a single sex school which comprised of all girls. All learners at the school were considered for sampling because they are affected by gender issues. As a result, they formed a homogeneous population without any overlapping characteristics. That made simple random sampling the most appropriate sampling type for the study site.

4.5.2.1.2 Systematic random sampling

This type of sampling is also used for homogeneous population, but it is a bit different from the simple random sampling in that there is no equal probability of every element being included as the elements are selected at a regular interval (Alvi, 2016:17; Kothari, 2004:62; Etikan & Bala, 2017:150). Kothari (2004:62) states that the interval may be in terms of time, space and order. Thus, it is this regularity and uniformity in selection that makes it systematic. Etikan and Bala (2017:150) stress that the list of elements may or may not be required before conducting research and that entirely depends on the nature of the study. Just like it is with the simple random, before taking a sample, the population needs to be defined and a list of all the elements of population obtained (Alvi, 2016:17; Kothari, 2004:62). The researcher then divides the total elements by the desired sample size to get the interval size. For instance, if the population consists of five hundred participants and the researcher needs a sample of fifty participants, then the interval size is ten. So, we need to select every tenth element. I did not settle for this type of sampling because of lack of equal probability for every element to be selected for inclusion in the study. This is caused by the selection of elements at regular intervals. However, I remained cognisant of the fact that the dividing line between the two types discussed so far could be thin. Some aspects of the systematic random sampling can be traceable in the simple random sampling.

4.5.2.1.3 Stratified random sampling

Stratified random sampling, according to Kothari (2004:62) is the same as those explained above, but the only difference is that this type of sampling is used on a heterogeneous population where elements differ from one another on certain characteristics. Stratification or grouping is a pre-defined criterion (Alvi, 2016:17). According to Kothari (2004:62) and Alvi (2016:17), the sub-groups which are referred to as strata may be based on gender, age, ethnicity, language and socio-economic status among others.

Thus, each stratum consists of elements that are different from another stratum's elements in some characteristics. Etikan and Bala (2017:150) state that the same methods of selecting participants used in simple random sampling and systematic random sampling can be applied to each strata of the population to come up with a representative sample for the study. Alvi (2016:17) notes that researchers can use the proportional allocation procedure or the equal allocation procedure to come up with a sample. According to Kothari (2004:62), using proportional allocation procedure, the sample size of a stratum is made proportional to the number of elements present in the stratum. If researchers employ the equal allocation procedure, the same number of participants is drawn from each stratum regardless of elements in each stratum. I settled for this sampling technique in the mixed sex school where stratification was needed. Firstly, I stratified learners according to gender and then applied simple random sampling.

4.5.2.1.4 Cluster sampling

Etikan and Bala (2017:150) define a cluster as a group of elements residing in the same geographical area or region. Cluster sampling as having the following characteristics: It is used when the elements of population are spread over a wide geographical area. Researchers who use this procedure divide the population into clusters or sub-groups based on the regions they reside such as cities, towns, mines, the countryside and so forth. If the clusters are not homogeneous, the heterogeneity of the population must be captured so that a truly representative sample can be extracted from the target population. An example was given of a researcher who selects cities only leaving towns where they could have been included as a scenario that does not present a true representative sample of the population. Sampling is therefore, done by dividing the population into clusters which are randomly or systematically selected. The selected clusters are then visited for data gathering. I did not use of cluster sampling because my participants (learners) were not spread over a wide geographical area. I therefore, sampled per study site and not per cluster.

4.5.2.1.5 Multi-stage sampling

The multi-stage sampling procedure, which is also referred to as sampling within a sample (Kothari, 2004:62) combines two or more probability sampling procedures at a time. It involves some stages and is used when the elements of population are spread over a wide geographical region (Etikan & Bala, 2017:150-151). Alvi (2016:17) states that multi-stage sampling is only used when it is not possible to obtain a representative sample with only one of the above examined sampling procedures. Etikan and Bala (2017:150) posit that the first stage may involve cluster selection followed by a heterogeneous population which may require the second stage, which is the stratified random sampling. Each stratum may be further divided into areas under study such as market places, shop owners, house owners and so forth. This sampling procedure is known as the multi-stage sampling procedure because one or more sampling procedures such as the systematic and stratified random sampling may be used within the selected clusters and strata at a time and in one sampling procedure. This sampling type was unsuitable for my study because I sampled per study site and not per cluster. Therefore, I did not use it in this study.

4.5.2.1.6 Quantitative sampling procedure guiding this study

I realised that since all learners regardless of gender and the subjects they were studying are directly affected by gender disparities, it was prudent to capture their views irrespective of the differences identified above. I used simple random sampling at a single sex school and stratified random sampling at a mixed sex school to come up with a sample of 193 for the two schools. Participants who were sampled from form 1-6 learners at the two schools were given questionnaires to establish if there was any significant difference in terms of boys’ and girls’ access to and performance in science and technology subjects.

Firstly, I considered if there were characteristics to use for grouping learners into different strata. Since the single sex school which comprised of girls was homogeneous, I made use of simple random sampling to come up with a total sample of 81 participants. With regards to a mixed sex school which comprised of boys and girls learning together, I found it appropriate to group learners according to gender and use stratified random sampling to come up with a sample of 112 participants.

4.5.2.1.7 Sampling procedure at the single sex school

All 160 learners in form 1 and 157 form 2 learners at the single sex school were sampled using the simple random sampling procedure. I noted that all learners identified above were studying the four science and technology related subjects offered by the school. The science subjects offered by the school which were within this study's scope were Mathematics, Physics and Chemistry. The only technology related subject offered at the school which was within this study's scope was Agriculture. With the help and advice from teachers at the school who were also participants in this study, I found it convenient, easy and necessary to randomly sample learners per form rather than per class level. No stratification was done. I extracted a sample of 10%, which according to me was representative and appropriate in this study. Using form 1 and 2 attendance registers obtained from class teachers, I compiled a list of all learners in form 1 as well as another for those inform 2. I then wrote learners' names on pieces of papers, put them in a bowl and mixed them thoroughly. This is called the lottery method (Alvi, 2016:17; Kothari, 2004:62; Etikan & Bala, 2017:150). To get a sample of 10%, I picked 16 papers in a form 1 bowl containing 160 papers and another 16 pieces of papers in a form 2 bowl containing 157 papers. A total of 32 participants, 16 in form 1 and 16 in form 2 constituted the sample for form 1 and 2 learners.

In form 3 and 4, the stratified random sampling was used to obtain a total sample of 28 learners. Of these, 15 were in form 3 and 13 were in form 4. Using subject enrolment registers, learners were stratified according to the subjects they were studying and then the simple random sampling or lottery method was used to extract the sample. I noted that all 151 learners in form 3 and 129 learners in form 4 were pursuing Mathematics and Integrated Science. Out of these, 41 learners in form 3 and 38 learners in form 4 opted to do Agriculture. In order to extract a truly representative sample, I deemed it necessary to extract a sample from learners who were doing science subjects without Agriculture and those who opted to pursue sciences with Agriculture. Out of 151 learners in form 3, a sample of 11 was extracted from 110 learners who pursued science subjects without Agriculture. From 41 learners who were doing Agriculture in addition to science subjects, a sample of 4 participants was obtained. Form 4 had 129 learners, and out of these 38 opted to pursue Agriculture in addition to mathematics and science subjects while 91 learners were doing sciences without Agriculture. The sample for science subjects without Agriculture was 9 and that for science subjects with Agriculture was 4.

The stratified random sampling was also used to extract a sample for form 5 and 6 learners at the single sex school. The sampling procedure used for form 3 and 4 learners was the same used for these classes. After stratifying learners into those doing science subjects, those who have included a technology related subject in their combinations and those whose combinations did not include any science and technology related subjects, the random sampling procedure was used to obtain a total sample of 21 learners. Using the lottery method, a sample of 3 learners was extracted from 29 form 5 learners pursuing science subjects only and another sample of 1 learner was extracted from 11 learners who included Agriculture in their combination. A sample of 8 learners was extracted from 78 form 5 learners whose combinations included neither science subjects nor Agriculture. Form 6 had 91 learners and using the lottery method, a sample of 2 learners was extracted from 22 learners who were doing science subjects only.

Another sample of 1 learner was extracted from 9 learners who included Agriculture in their subject combination. A sample of 6 learners was extracted from 60 form 6 learners whose combination included neither science subjects nor Agriculture. A total of 81 learners constituted a sample for this study from form 1-6 at a single sex school.

4.5.2.1.8 Sampling procedure at the mixed sex school

Stratified random sampling was used for form 1 and 2 learners at a mixed sex school. Since they were pursuing the same subjects, they were grouped according to gender using the class attendance registers. Sampling, according gender was done in order to extract a truly representative sample from the target population. In addition to the science subjects, both forms were doing Agriculture. Using attendance registers, I wrote names of learners on pieces of papers per form per gender. The papers were put in a bowl and mixed thoroughly. The lottery method was then applied to extract samples. To get a sample of 10% from each gender, I picked 10 papers from a form 1 boys' bowl containing 100 papers. I also picked 12 papers from a form 1 girls' bowl containing 117 papers. In form 2, I picked 11 from a form 2 boys' bowl containing 105 papers. I also picked 11 papers from a form 2 girls' bowl containing 112 papers. A total of 44 participants constituted a sample for form 1 and 2 learners.

For form 3 and 4 learners at a mixed sex school, I employed the stratified random sampling procedure to extract a sample of 42 participants. I used the subject enrolment registers for learners and grouped them according to gender. After that, I further stratified them according to the subjects they were studying with specific focus on science and technology. Science and Mathematics were done by all form 3 and 4 learners but I was also interested in those who opted to pursue Wood Work, Technical Graphics, Building and Agriculture, the four technology related subjects offered by the school. Out of 5 technology related subjects that form the scope of this study, only those named above are offered by the school. Form 3 and 4 learners had an option of choosing only 1 amongst the 4.

I grouped learners into boys studying science subjects with one of the technical subjects named above. I also grouped girls in the same way. Each group's names were written on pieces of papers per form, per gender and according to subjects studied. The papers with learners' names were put in different bowls and mixed thoroughly. Using the lottery method, 10% was extracted to constitute the sample for the 2 forms. The samples were obtained as follows: Out of 111 boys and 125 girls in form 3 as well as 81 boys and 87 girls in form 4, I picked 3 papers in a bowl containing 29 papers for form 3 boys doing Wood Work, 3 papers in a bowl containing 33 papers for form 3 boys pursuing Agriculture. I then picked 2 papers in a bowl containing 15 papers for form 3 boys doing Building and 2 papers in a bowl containing 24 papers for form 3 boys doing Technical Graphics. I also picked 1 paper in a bowl containing 11 papers for form 3 boys who opted to pursue technology related subjects which were outside this study's scope. For girls, I picked 1 paper in a bowl containing 12 papers for form 3 girls doing Agriculture and 1 paper in a bowl containing 5 papers for form 3 girls pursuing Wood Work. I then picked 1 paper in a bowl containing 2 papers for form 3 girls doing building and 1 paper in a bowl containing 4 papers for form 3 girls doing Technical Graphics. I also picked 10 papers in a bowl containing 102 papers for form 3 girls who opted to pursue technology related subjects which were outside this study's scope. In form 4, which had 81 boys and 87 girls, I picked 1 paper in a bowl containing 12 papers for boys studying Agriculture and 1 paper in a bowl containing 9 papers for boys pursuing Technical Graphics. I then picked 1 paper in a bowl containing 10 papers for boys who were studying Wood Work and 1 paper in a bowl containing 9 papers for boys pursuing Building. I also picked 4 papers in a bowl containing 41 papers for form 4 boys who opted to pursue technology related subjects which were outside this study's scope. With regards to form 4 girls, I picked 1 paper in a bowl containing 5 papers for girls who were pursuing Agriculture and 1 paper in a bowl containing 2 papers for girls who were studying Technical Graphics. None of the girls opted to study Building and Wood Work. I also picked 8 papers in a bowl containing 80 papers for form 4 girls who opted to pursue technology related subjects which were outside this study's scope.

The stratified random sampling was also used to extract samples from form 5 and 6 learners at a mixed sex school. The school did not offer any technology related subject that was within this study's scope to its form five and six learners. The sampling procedure used for form 3 and 4 learners above was the same used for form 5 and 6 learners. After stratifying learners based on gender, further stratification was carried out with those pursuing any one of the science subjects offered, namely, Mathematics, Physics and Chemistry put in one stratum. Those who chose to study purely arts and commercials without any science subject were grouped together. I wrote each group's names on pieces of paper per form and according to gender as well as the subjects which they were studying. I put papers in a bowl and mixed them thoroughly. I then sampled 10% from each stratum using the simple random sampling. The samples were extracted as follows: I picked 3 papers in a bowl containing 33 papers for form 5 boys who included a science subject in their combination. I also picked 4 papers in a bowl containing 41 papers for form 5 boys who excluded a science subject in their combinations. With regards to form 5 girls, I picked 3 papers in a bowl containing 28 papers for girls who included a science subject in their combination. I then picked 4 papers in a bowl containing 40 papers for form 5 girls who excluded a science subject in their combinations.

In form 6, I picked 3 papers in a bowl containing 31 papers for form 6 boys who included a science subject in their combination. I then picked 3 papers in a bowl containing 30 papers for form 6 boys who excluded a science subject in their combination. With reference to form 6 girls, I picked 3 papers in a bowl containing 25 papers for girls who included a science subject in their combination. Again, I picked 3 papers in a bowl containing 30 papers for form 6 girls who excluded a science subject in their combination. A total of 26 participants constituted the sample for form 5 and 6 learners. The mixed sex school had a sample of 112 learners. Altogether 193 learners at the single sex school and the mixed sex school constituted a sample for questionnaire administration in this study.

Table 4.2: Quantitative Sample Size for the Study

Participants	Single Sex School		Mixed Sex School		Total
	Population	Sample	Population	Sample	
Form 1 learners	160	16	217	22	38
Form 2 learners	157	16	217	22	38
Form 3 learners	151	15	236	25	40
Form 4 learners	129	13	168	17	30
Form 5 learners	118	12	142	14	26
Form 6 learners	91	9	116	12	21
Total	**806**	**81**	**1096**	**112**	**193**

4.5.2.2 Qualitative sampling procedure for the study

Non-probability sampling is defined as a sampling procedure which does not afford any basis for eliminating the probability that each item in the population has in being included in the sample (Kothari, 2004:59). Etikan and Bala (2017:149) define non-probability sampling as a sampling procedure that will not bid a basis for any opinion of probability that elements in the universe will have a chance to be included in the study sample. According to Alvi (2016:14), in non-probability sampling which is also known as judgement or non-random sampling, every unit of population does not get an equal chance of participation in the study. Thus, the selection of the sample is made on the basis of subjective judgement of the researcher.

This observation is corroborated by MacDonald and Headlam (2012:69) who posit that in non-probability sampling, which is also referred to as non-random sampling, the principle of randomness is not maintained in the selection of a sample. It is evident from the above definitions that non-probability sampling does not allow a known probability that each element of the target population will be chosen. It is for this reason that this sampling procedure is referred to as non-random sampling. The most common used non-probability sampling procedures in research are purposive sampling, criterion sampling and snowball sampling (Alvi, 2016:28; Etikan & Bala, 2017:129; Kothari, 2004:59; Maree, 2011:79).

4.5.2.2.1 Purposive sampling

According to McMichael (2008:463), researchers should seek to include people who represent the widest variety of perspectives possible within the range specified by their purpose. In the same vein, Engel and Schutt (2013:126) indicate that in purposive sampling, each sample element is selected for a purpose usually because of the unique position of the sample elements. Etikan and Bala (2017:129) say purposive sampling purposively focuses on a particular subset of a population and is based on the researchers' prior knowledge of the population. Alvi (2016:28) observes that the criteria for the elements to be included in the study are pre-defined. In other words, items for the sample are deliberately selected by the researcher and his or her choice concerning the items remains supreme. Thus, researchers do not include everyone in the sample, but only those who meet the defined criteria. I used purposive sampling because I had in mind people who have knowledge on gender issues. These are heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers at the selected schools.

4.5.2.2.2 Criterion sampling

This sampling procedure implies that the researcher sets criteria for the participants to be included in the study (Kothari, 2004:59; Etikan & Bala, 2017:129). Maree (2011:79) states that the criteria may include gender, age, place of residence, profession and others. The criteria chosen, which may also include the number of participants assists in selecting a study sample. I did not make use of criterion sampling because there was no set criterion for my participants to be included in the study.

4.5.2.2.3 Snowball sampling

Maree (2011:79) posits that the snowball sampling procedure is done by using networks. Etikan and Bala (2017:129) note that snowball sampling is used when the researcher knows little about a group or organisation that he or she wishes to study. The researcher's contact with few individuals will direct him or her to other group members (Kothari, 2004:59). Alvi (2016:28) gives an example of the researcher who is studying issues to do with homeless households who have to rely on networks. He or she gets hold of one person who will tell him or her where the others are or can be found. When he or she find others, they will tell him or her where to get more and the chain continues. In short, this sampling procedure, which is also known as chain referral sampling is used to find hidden populations or groups which are not easily accessible to researchers. I did not use this type of sampling because there were no networks involved in my study and my participants were easy to access.

4.5.2.2.4 Qualitative sampling procedure guiding this study

This study employed the non-probability purposive sampling procedure to come up with a sample comprising 44 respondents at a single sex school and a mixed sex school. The sample provided information on factors that cause boys' and girls' differential access and performance in science and technology subjects at school. Of these respondents,21 were from a single sex school and 23 were from a mixed sex school. The sample from a single sex school was drawn as follows: Head of school, the deputy head, 1 science subjects HOD, 1 technology subjects HOD, 8 science subjects class teachers, 2 technology subjects class teachers, 5 science subjects teachers and 2 technology subjects teachers. The sample from a mixed sex school comprised of the head of school, the deputy head, 1 science subjects HOD, 1 technology subjects HOD, 9 science subjects class teachers, 2 technology subjects class teachers, 5 science subjects teachers and 3 technology subjects teachers. All the above school-based stakeholders at a single sex and a mixed sex school were purposively sampled because they were perceived to have in-depth knowledge on gender issues. As people in authority, heads of schools, their deputies, HODs and class teachers were regarded as the right people to provide first-hand information on the society's role in promoting gender inequalities in the teaching of science and technology subjects in schools. Science and technology subject teachers who are curriculum implementers were chosen to tap their expertise, views and experiences with regards to the manner in which gender socialisation affects boys' and girls' education in science and technology.

Educators were articulate and confident, hence my decision to prioritise them for interview purposes ahead of learners to whom I administered questionnaires. As a result, I was able to generate rich data with regards to how society promotes gender disparities in the teaching and learning of science and technology subjects in schools. Altogether, a total of 237 respondents made up of 193 learners and 44 teachers from a single sex and a mixed sex school constituted the sample for this study (Table 4.2).

Table 4.3: Qualitative Sample Size for the Study

Respondents	Single Sex School	Mixed Sex School	Total
Heads of Schools	1	1	2
Deputy Heads	1	1	2
Science Subjects HODs	1	1	2
Technology Subjects HODs	1	1	2
Science Subjects Class Teachers	8	9	17
Technology Subjects Class Teachers	2	2	4
Science Subject Teachers	5	5	10
Technology Subject Teachers	2	3	5
Total	**21**	**23**	**44**

4.6 DATA GATHERING INSTRUMENTS IN MIXED METHODS STUDIES

According to Ponto (2015:169), data gathering instruments are items used to measure what they are intended to measure. Check and Schutt (2012:160) view data gathering instruments as items used to collect information from a sample of individuals through their responses to questions. Similarly, Mathers et al, (2009:19) defines data gathering instruments as convenient items used to collect useful data from a sample of individuals from a study. From the above definitions, data gathering instruments can be referred to as items used to collect data from the study sample.

4.6.1 Quantitative Data Gathering Instruments

This study used the questionnaire schedule and the document analysis protocol to collect quantitative data. Quantifiable data were complemented with qualitative data generated from interviews. The qualitative data gathering instrument is discussed later in this section.

4.6.1.1 The questionnaire guide

Mhlanga and Ncube (2003:59) view a questionnaire as a document consisting of question items that solicit information from a subject, which is suitable for research analysis. The above definition is in harmony with that of MacDonald and Headlam (2012:18) who observe that questionnaires can be used in a wide range of settings to gather different types of information. Kumar (2011:138) defines a questionnaire as a written list of questions, the answers of which are recorded by respondents. Kothari (2004:100) concurs and posits that a questionnaire is a document containing questions that is sent, either by post or directly to people concerned with a request to answer the questions and return the questionnaire. Therefore, a questionnaire can be regarded as a document containing questions designed to solicit information from participants for analysis.

In this study, I personally administered the questionnaires (Appendix 6) with closed ended questions to a total of 193 selected form 1-6 learners at a single sex school and a mixed sex school. The number was deemed sufficient to gather required data for comparison with other data gathering approaches such as document analysis and interviews. Questionnaire guides obtained quantifiable data on the nature of boys' and girls' access to and performance in science and technology subjects at school.

Learners were chosen for questionnaire administration in order to vary and allocate my sampled participants to the available data gathering approaches. I also felt that learners were less articulate and confident than their teachers, hence my decision to give them questionnaire guides rather than interviewing them. Furthermore, questionnaire guides enabled me to gather data from a large number of people who answered the questions at their own pace Mathers et al, (2009:19); Kumar, 2011:138). Questionnaire guides had two sections (Appendix 6). The first section collected biographical information while the other section gathered quantifiable data on the frequency (f) of responding to given questions on the nature of boys' and girls' access to science and technology subjects in schools. Participants' responses were categorised onto a Likert Scale, using Strongly Agree (SA) and Agree (A) as the positive responses, and Disagree (DA) and Strongly Disagree (SDA) as the negative responses on differential treatment of boys and girls in science and technology subjects in schools. The neutral or undecided form of responses was not used in order to give clarity and direction when making an analysis. A typical example of one of the questions asked was: Our teachers make efforts to ensure that boys and girls at this school have equal chances to study science and technology subjects (Appendix 6).

The Likert Scale, according to Mathers et al, (2009:27), is one of the most commonly used scales in which respondents are presented with one or more statements and asked to score each statement on a multi-point scale. MacDonald and Headlam (2012:66) define a Likert Scale as a method used to measure attitudes, which involves respondents indicating their degree of agreement or disagreement with a series of statements. Scores are summed to give a complete measure of attitudes. The scholars advise researchers to think very carefully about how they word their statements to ensure that they are comparable with regards to aspects they may want to compare their findings. Using a four-point Likert Scale with carefully worded statements (Appendix 6), I ensured a 100% questionnaire return yield by self-delivering and collecting them to a large group of one hundred and ninety-three learners at a single sex school and another at a mixed sex school.

Self-administration of questionnaires gave me an opportunity to establish rapport with the participants and to explain clearly the purpose of the study. I also had a chance to explain clearly the meaning of items on the questionnaires that were unclear to the participants. Explaining and clarifying technical terms to the participants ensured the validity, reliability and utility of the questionnaire items.

It is imperative to reiterate that the questionnaire was used in this study because it is cheaper and quicker and can be administered to a large number of people at once (Mathers et al, 2009:9). It also allows participants to answer questions at their pace and leisure, thus giving them more freedom to express themselves.

4.6.1.2 Document analysis protocol

The study of documents (Appendix 4) was also done to establish if there was any significant difference in performance between boys and girls in science and technology subjects at a single sex school and a mixed sex school. Kothari (2004:110) points out that documents can be documentary material such as books, magazines, newspapers or any other confidential and non-confidential information. Similarly, MacDonald and Headlam (2012:51) assert that studying documents can generate a lot of material which the investigator can synthesise. In the same vein, Mogalakwe (2006:224) notes that documents for analysis range from public documents such as policy statements, private documents from private sector businesses and personal documents such as diaries and personal letters. Thus, studying documents was part of this research's strategy to solicit information for analysis.

With regards to documents, heads of schools were contacted using the consent form, the purpose of the documents explained and an agreement to avail them was sought. I accessed Zimbabwe Schools Examinations Council (ZIMSEC) 2016 – 2017, 'O' and 'A' Level final examinations results (Appendix 4). I did not use the class registers because they could only give me access results. I therefore, preferred to use the above-mentioned documents which simultaneously generated access and performance results for the study. I derived data on boys' and girls' access to science and technology subjects from the documents. The documents also enabled me to establish if there was any significant difference in terms of boys' and girls' performance in science and technology subjects. Technology related subjects which were of interest to this study were Technical Graphics, Agriculture, Building, Wood Work and Metal Work. These, together with Mathematics, Physics and Chemistry are traditionally regarded as male dominated subjects (European Commission (EC), 2009:3).

4.6.2 Qualitative Data Gathering Instruments

This study used an interview guide to gather qualitative data on how society influences boys' and girls' access to and their performance in science and technology. The interviews were conducted in a safe and quiet environment which was free from disturbances.

4.6.2.1 The interview schedule

According to MacDonald and Headlam (2012:40), interviewing refers to structured or unstructured verbal communication between the researcher and the respondents, in which information is presented to the researcher. Kumar (2011:13) refers to an interview as a commonly used approach of collecting information from people. Kothari (2004:97) also views the interview as a method of collecting data involving presentation of oral-verbal stimuli and reply in terms of oral-verbal responses.

This means that the main purpose of the interaction which takes place between the researcher and the respondents during the interview process is to collect data in a manner that is holistic, emic, contextualised, interpretive and immersed. Gathered data would then be reduced and organised to produce findings that require interpretation by the researcher.

At the single sex school, I interviewed the head of school, the deputy head, one science subjects HOD, one technology subjects HOD, eight science subjects class teachers, two technology subjects class teachers, five science subject teachers and two technology subject teachers. The total number of interviewees at the single sex school was 21. At the mixed sex school, I interviewed the head of school, the deputy head, one science subjects HOD, one technology subjects HOD, nine science subjects class teachers, two technology subjects class teachers, five science subject teachers and three technology subject teachers. The total number of interviewees at the mixed sex school was 23. The total number of all respondents who provided their views and experiences on factors that could influence access to and performance of boys and girls in science and technology subjects was 44 (Table 4.3).

According to MacDonald and Headlam (2012:40), there are three types of interviews which are: structured, semi-structured and unstructured interviews. Structured interviews, according to the scholars follow a set of specific questions, which are worked through systematically. This type of interview is used when the researcher wishes to acquire information where the responses are directly comparable. The semi-structured interview approach follows a framework in order to address key themes in addition to specific questions. Using this technique allows a certain degree of flexibility for the researcher to respond to answers of the interviewees and therefore develop the questions or themes as well as other issues as they arise. The unstructured interview method does not follow any predetermined pattern of questions or themes, rather, the interviewer will address the issues as they emerge in the interview (MacDonald & Headlam, 2012:40).

I used the semi-structured interview schedule (Appendices 7) which falls between the structured and the unstructured interviews (Kumar, 2011:137-138). Its anchorage on the structured and unstructured interviews as well as some measure of flexibility enabled me to respond to answers of the interviewees in a more useful way than others types of interviews (MacDonald & Headlam, 2012:40). I used it to gather data from interviewees and explore issues with regards to the nature of boys' and girls' access to and their performance in science and technology subjects at school. The interview processes gave me room to probe deeper and uncover more information and explanations on factors that can influence the difference in performance of boys and girls in science and technology subjects.

Overall, using the individual interview approach of gathering data helped to improve the interpersonal dynamics between me and participants. By so doing, interviewees were generous with their time and expertise. It also established trust and rapport that yielded insights through not only rephrasing questions, but also using the mother tongue for clarifications (Kumar, 2011:1138). I regarded the individual interview approach as an effective way of collecting data because apart from soliciting more information by probing, prodding and cajoling, it enabled me to observe and interpret non-verbal responses (Makore-Rukuni, 2001:15). That was made possible by the fact that, interview questions were open-ended which sought to discover, explore and describe experiences (Onwuegbuzie & Leech, 2006:482). Thus, open-ended questions were evolving and non-directional, for instance, 'In your view, does the home influence boys and girls to choose different subjects at school? Explain your answer (Appendix 6). As a result, they gave me room for deeper exploration, probing, decoding, interpretation and explanation of issues raised. Combining interviews (Appendix 7), questionnaires (Appendix 6) and the study of records (Appendix 4) enhanced comparison of findings.

4.7 DATA ANALYSIS IN MIXED METHODS STUDIES

The purpose of data analysis, according to Creswell (2002:95), is to describe the data clearly, identifying what is typical and atypical of the data, bringing to light differences, relationships and other patterns existing in the data, and ultimately answering research questions or test hypotheses. Burns and Grove (2003:479) define data analysis as a mechanism for reducing and organising data to produce findings that require interpretation by the researcher. The above definitions dovetail with that of De Vos (2002:339) who views data analysis as a challenging and creative process characterised by an intimate relationship of the researcher with the participants and the data generated. From the above observations, analysis of data can be viewed as a way in which the researcher reduces and organises collected data to produce findings that require his or her interpretation.

This section briefly explores types of quantitative data analysis. These are descriptive statistical analysis and inferential statistical analysis. It also discusses types of qualitative data analysis such as content and thematic analysis. Quantitative and qualitative data analysis were undertaken separately since both needed to be conducted with rigour and care.

4.7.1 Quantitative Data Analysis

According to Kreuger and Neuman (2006:434), quantitative data analysis is statistical. The scholars state that statistical analysis is a mathematical method of reducing and organising data presented in frequency tables and graphs. MacDonald and Headlam (2012:20) contend that statistical analysis makes use of numerical data presented in graphical form for evaluation purposes. Thus, analysis is done by looking for relationships between different sets of data to explain what is observed (MacDonald & Headlam, 2012:24).

The two types of statistical analysis that can be used by researchers are descriptive and inferential statistics (Kothari, 2004:131). The scholar notes that descriptive statistics involves the analysis of numerical summaries of what was observed. Thus, researchers use statistical analysis to summarise data on what was observed into a shorter form. Inferential statistics entails analysing data from samples or populations that could have been or will be observed (Kreuger & Neuman, 2006:434). Thus, inferential statistics can be said to be predictive in that it analyses and generalises data based on samples or populations that were not observed at all but could have been observed or will be observed. Thus, statistical analysis, whether descriptive or inferential should only be used where there is a clear understanding of the reasons for doing so in order to generate valuable findings that inform the study. In this study, I made use of descriptive statistics when analysing numerical summaries on the ZIMSEC 2016 – 2017, 'O' and 'A' Level final examinations results documents (Appendix 4) from the single sex and the mixed sex school. After chi-square calculations on the same documents to establish if there was any significant difference in performance of boys and girls at the above-named schools, I made use of both descriptive and inferential statistical analysis to draw conclusions. After chi-square tests on questionnaires (Appendix 6) to establish if there was any significant difference in terms of boys' and girls' access to and performance in science and technology subjects, I employed both descriptive and inferential statistical analysis to discuss results.

4.7.1.1 Quantitative data analysis for the study

I used the four-point Likert Scale to present and analyse quantitative data obtained from questionnaires (Appendix 6). After presenting data from questionnaires using the above-named table, descriptive statistical analysis was employed to draw conclusions from gathered quantifiable data on the frequency (f) of responding to given questions on the nature of boys' and girls' access to and performance in science and technology subjects. Conclusions from data presented on the Likert Scale were done by means of the chi-square and binomial calculations to establish if there was any significant difference in boys' and girls' access to and performance in science and technology subjects at the single sex and the mixed sex school. I then went on to present data on boys' and girls' performance in science and technology subjects using the ZIMSEC 2016 – 2017, 'O' and 'A' Level final examinations results documents (Appendix 4) from the single sex and the mixed sex school. To establish the presence of any significant difference in terms of boys' and girls' performance in science and technology subjects using the documents identified above, I made use of the chi-square calculations to draw conclusions. The same documents were subjected to binomial tests for access results. I then used descriptive statistical analysis to draw conclusions from gathered quantifiable data to discuss findings.

4.7.1.1.1 The chi-square tests

Kothari (2004:233) defines the chi-square as a statistical measure used in the context of sampling analysis for comparing a variance to a theoretical variance or to make comparisons between theoretical populations and actual data when categories are used. MacDonald and Headlam (2012:62) also define a qui-square as a family of distributions commonly used for significance testing when comparing two categories of data. Diener-West (2008:4) contend that the chi-square test which compares observed counts with expected counts is used to test the hypothesis of association or no association between two or more variables, groups or populations. Kostalova (2010:165) asserts that in a chi-square test of independence, the null and alternative hypotheses are expressed as follows: Firstly, we have (Ho) where the two statistical figure values are independent. Secondly, we have (Ha) where the two statistical figure values are related. Kostalova stresses that if the null hypothesis (Ho) which shows no significant difference between two variables is unlikely, then the alternative hypothesis (Ha) which depicts the significant difference between two variables being compared is likely.

Diener-West (2008:15) says if statistical results show that there is an association or significant difference between the two variables being compared, the percentage value (p) would be less than 0.05 (p-value<0,05). If statistical results show that there is no association or significant difference between the two variables being compared, the percentage value (p) would be more than 0.05 (p-value>0,05). Similarly, Hanlon and Larget (2011:68) posit that researchers use the chi-square to test the goodness of fit, to test the significance of association between two attributes and to test the homogeneity or the significance of population variance.

In this study, I used the chi-square to establish if there was any significant difference in access to and performance in science and technology subjects using the questionnaire instrument (Appendix 6) and ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final examinations results documents from a single sex and a mixed sex school (Appendix 4). The comparison was between girls in a single sex school and their counterparts in a mixed sex school. Again, a comparison of boys and girls learning together at a mixed sex school as well as boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of their access to and performance in science and technology subjects at school.

4.7.1.1.2 The binomial tests

According to Hanlon and Larget (2011:15), the binomial test for proportion is used to test the hypothesis of significant difference or its absence between two variables. The authors note that it is a two-tailed test that is used to test if either of the proportions is equal to 0.5. An example was given as follows: Proportion (**p**) is equal to 0.5 versus a two-sided alternative hypothesis to prove that the proportion is equal or not equal to 0.5. When we note that the proportion of A and B are not equal and does not sum up to unity 1, then we know that there is need for further tests to establish the magnitude of difference (Smit & Ross, 2005:31).

Expressed differently, if we can prove that the proportion A is not equal to 0.5, it would be sufficient to observe the differences that exist between A and B. Further tests are done and if statistical results show that there is significant difference between the two variables being compared, the percentage value (p) would be less than 0.05 (p-value<0,05). If statistical results show that there is no significant difference between the two variables being compared, the percentage value (p) would be more than 0.05 (p-value>0,05) (Caffo, 2007:10).

In this study I used the binomial test to establish if there was any significant difference in access to science and technology subjects using ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final examinations results documents from a single sex and a mixed sex school (Appendix 4). A comparison was between girls in a single sex school and their counterparts in a mixed sex school. Another comparison of boys and girls learning together at a mixed sex school as well as boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of their access to and performance in science and technology subjects at school.

4.7.2 Qualitative Data Analysis

According to Kumar (2011:308) qualitative data is usually subjected to an interpretive frame of analysis as opposed to a statistical framework of analysis for quantitative data. Thus, qualitative data analysis from interviews in this study centred around interpreting thick, detailed and rich descriptions of participants’ views and experiences with regards to factors that promote gender inequalities in the teaching and learning of science and technology related subjects (Shenton, 2004:69; Morrow, 2005:252). There are two types of qualitative data analysis as posited by De Vos (2002:340-341). These are thematic analysis and content analysis.

4.7.2.1 Content analysis

According to Golafshani (2003:600), qualitative research design that is informed by the interpretivist paradigm uses a naturalistic approach that seeks to understand phenomena in context settings by illuminating, understanding and exploring situations. This view dovetails with that of Ramlo and Neuman (2011:177) who assert that qualitative research design focuses on rich description and the meaning of phenomena based on perspectives of whoever is under examination. Similarly, Willis (2007:40) posits that qualitative research design tends to be rich with quotations, descriptions and narrations as researchers attempt to capture conversations, experiences, and perspectives.

Content analysis is defined by Maree (2011:75), De Vos (2002:340) and Kumar (2011:210) as a systematic approach to qualitative data analysis in which researchers identify, summarise and make inferences on the content of views expressed by study participants. This view dovetails with that of Hsieh and Shannon (2005:1278) who assert that content analysis involves the subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes and patterns. Similarly, Patton (2002:452) posits that content analysis involves a process to condense raw data into categories or themes based on the researcher’s careful examination of the data or content. Consistent with the above views, Vaismoradi, Turunen and Bondas (2013:400) note that the purpose of content analysis is to describe the characteristics of content by examining emerging themes drawn from given data or content. Maree (2011:75), De Vos (2002:340) and Kumar (2011:210) suggest that researchers need to first decide whether they want to analyse gathered information manually or using a computer programme. The next stage would be to go through field notes and directly integrate topics or data that relate to each other into one category for the purpose of detailed analysis and interpretation. An important point to make is that, it is content that gives us themes. Therefore, I made use of both during qualitative data analysis in this study.

4.7.2.2 Thematic analysis

Kumar (2011:210) posits that content and theme analysis are inseparable in that the researcher identifies the study’s main themes through analysing the contents of the information gathered in the field. This view is consistent with that of Ibrahim (2012:39) who posits that thematic analysis is a comprehensive process where researchers are able to identify numerous cross references between content or data and the research’s evolving themes. Similarly, Vaismoradi, Turunen and Bondas (2013:398) observe that there is a thin boundary separating content and thematic analysis in that, thematic analysis measures the frequency of different categories or themes from given content. Maree (2011:75) and De Vos (2002:30) are of the view that, as researchers conduct content analysis, they look for specific words for which themes can be identified or generated. Thus, with regards to interviews, field notes are read by researchers over and over again to identify the main themes. These themes become the basis of the researcher's write-up. Content and theme analysis are inseparable because we derive themes from content. As a result, I used both simultaneously in this study as they helped me to produce an insightful analysis that answered my research questions (Judger, 2016:2).

4.7.2.3 Qualitative data analysis for the study

After conducting interviews (Appendix 6) in this study, I analysed content to interpret thick, detailed and rich descriptions of heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers with regards to how society promotes gender disparities in the teaching and learning of science and technology subjects. The interviews were audio recorded and notes were taken to enable further analysis and interpretation without losing details. I listened to each respondent's views and experiences from my voice recorder followed by reading and re-reading the verbatim information (Henning, 2004:127).

This gave me room to be immersed again in the data and look for specific words to generate themes (Table 5.1). Data from the themes were analysed manually by looking for categories of responses that emerged from them. It is important to point out that, respondents' clarifications, elaborations and non-verbal responses during data collection enabled the final description of this study to be comprehensive and exhaustive.

4.8 MEASURES OF QUALITY CONTROL IN MIXED METHODS STUDIES

I used validity and reliability of the quantitative research as well as trustworthiness of the qualitative research as measures of quality control.

4.8.1 Validity and Reliability of the Quantitative Research

Validity and reliability of research instruments influence the extent to which we learn something about the phenomenon we are studying in quantitative research approach.

4.8.1.1 Validity of the quantitative research

Validity according to Joppe (2000:1) determines whether the research truly measures that which it was intended to measure or how truthful the research results are. Leedy and Ormrod (2010:17) view validity as the extent to which a research instrument measures what it is intended to measure. Golafshani (2003:598) avers that on measuring the validity of an instrument, the focus is to ensure replicability or repeatability of the result. Thus, replicability and repeatability are fundamental if the research instruments are to be regarded as valid in quantitative research. These scholars concur that data are valid if they provide a true picture of what is being studied.

Validity therefore, refers to how sound and effective the measuring instrument is. Thus, a valid statement should reflect social reality.

Kothari (2004:74) observes that there are basically three types of validity and these are: criterion-related validity, construct and content validity. The following are definitions of the three types of validity.

4.8.1.1.1 Criterion-related validity

Kothari (2004:74) posits that criterion-related validity relates to the researcher's ability to predict or estimate the existence of some current condition. Thatcher (2010:145) states that the purpose of criterion-related validity is to use an instrument to estimate some important form of behaviour that is external to the measuring instrument itself. Kumar (2011:168) also views criterion-related validity as the degree to which an instrument can forecast the existence of some current condition or an outcome. In view of the above definitions, criterion-related validity examines whether the responses are able to predict a criterion measure. I did not make use of criterion-related validity because predictions and estimations were not necessary in my study.

4.8.1.1.2 Construct validity

According to Kumar (2011:168), construct validity is determined by ascertaining the contribution of each construct to the total variance observed in a phenomenon. Kothari (2004:74) posits that a measure is said to possess construct validity if it confirms to predicted correlations to other theoretical propositions. Similarly, Thatcher (2010:147) defines construct validity as the extent to which a particular measure relates to other measures consistent with theoretically derived hypotheses concerning the concepts that are being measured. Thus, construct validity refers to whether the instrument questions capably measure hypothetical constructs.

I made use of construct validity in this study because my questionnaires are capable of measuring stated hypotheses.

4.8.1.1.3 Content validity

Content validity is viewed by Thatcher (2010:141) as the extent to which an empirical measurement reflects a specific domain of content. According to Kumar (2011:167), content validity is judged on the basis of the extent to which statements or questions represent the issue they are supposed to measure. In the same vein, Kothari (2004:74) defines content validity as the extent to which a measuring instrument provides adequate coverage of the topic under study. These definitions are anchored on the accuracy with which an instrument measures the factors of or situations under study. Thus, I was interested in the content validity of the questionnaire guides (Appendix 6) which were administered to a total of 193 selected form 1-6 learners at a single sex school and a mixed sex school.

To establish the degree of content validity within the questionnaire schedules, I exposed them to this study’s selected participants, my promoters, peer researchers, student advisors and colleagues for examination so that errors could be minimised. Apart from detecting flaws within the questionnaire guides (Appendix 6), their exposure to seasoned researchers and scholars for scrutiny enabled me to ascertain the extent to which they provided adequate coverage of the themes under study. Furthermore, input from other people widened my horizon in terms of the extent to which society could influence the differences in access and performance of boys and girls in science and technology subjects. This helped to produce a true picture of what was being studied.

4.8.1.2 Reliability of the quantitative research

According to Joppe (2000:1), reliability refers to the "extent to which results are consistent over time and an accurate representation of the total population under study... if the results of a study are produced under a similar methodology, then the research instrument is considered to be reliable." Leedy and Ormrod (2010:17) view reliability as the consistency with which a research instrument yields a certain result when the entity being measured has not changed. MacDonald and Headlam (2012:12) define reliability as the extent to which the same result will be repeated and achieved by using the same measure. Shenton (2004:71) observes that in addressing the issue of reliability, the positivists employ techniques to show that if the work was repeated in the same context, with the same participants, similar results would be obtained. In light of the above observations, reliability can be viewed as the degree of consistency the chosen instruments demonstrate. The issue of reliability deals with the question of establishing the extent or degree of accuracy with a particular research instrument.

It is important to point out that for any research instrument to be reliable in quantitative research, it must be free from errors (Shenton, 2004:71; Morrow, 2005:252). Kreuger and Neuman (2003:179) suggest the following methods of improving reliability in quantitative research instruments:

- Increasing the number of items or observations, i.e. the use of multiple indicators of a variable.
- Elimination of items which are unclear.
- Standardising the conditions under which the test is undertaken.
- Moderating the degree of difficulty of the instrument.
- Minimising the effects of external events.
- Standardising instruments.
- Maintaining consistent scoring procedures; and
- Using pre-tests, pilot studies and replications.

To ensure that reliability was established within the questionnaire guides in this study, I exposed them to my promoters, peer researchers, student advisors, colleagues and some of my participants for advice and constructive criticism to enhance their accuracy. The exposure minimised errors by eliminating items which were unclear. Furthermore, the moderation of the instrument culminated into its standardisation which ensured the reduction of its degree of difficulty. The exposure of the instrument to the above-named people also ensured that if the study was repeated in the same context with the same participants, similar results would be obtained. Overall, people's input minimised not only errors, but also the degree of difficulty on the questionnaire guide as well as the clarity of instructions (Appendix 6). This helped to produce reliable questionnaire instruments.

4.8.2 Trustworthiness of the Qualitative Research

Rolfe (2006:304) describes trustworthiness as frameworks and guidelines for judging the quality of qualitative research. Similarly, Shenton (2004:63) views trustworthiness of qualitative research as frameworks for ensuring rigour. Streubert-Speziale and Carpenter (2003:29) also state that the goal of rigour in qualitative research is to accurately represent the study respondents' experiences. Thus, these scholars concur that qualitative research is trustworthy if it accurately represents the experiences of the study respondents who in this study were heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers.

Lietz and Zayas (2010:1) provide a succinct summary of trustworthiness in qualitative research by pointing out that a study is trustworthy if steps are taken in the research procedures to ensure that views or perspectives of participants are authentically gathered and accurately represented in the findings. In this study, I collected raw data using interview schedules (Appendix 7) and the voice recorder, analysed and synthesised it making sure that the conclusions of the study's findings were supported by the gathered data.

I then took the necessary steps to compile thick, detailed and rich descriptions of the respondents' experiences on the nature of access to and performance in science and technology subjects by boys and girls at the single sex and the mixed sex schools. I also compiled thick, detailed and rich descriptions on factors that could influence boys' and girls' access to and performance in science and technology subjects. I also ensured the trustworthiness of this study during and after fieldwork by addressing in detail the four parallel criteria that work together to achieve trustworthiness namely: credibility, transferability, dependability, which is also known as auditability and confirmability.

4.8.2.1 Credibility of the qualitative research

Credibility, according to Shenton (2004:63) refers to the investigator's attempt to demonstrate that a true picture of the phenomenon under scrutiny is being presented. Morrow (2005:252) assert that credibility refers to the idea of internal consistency, where the core issue involves ensuring rigour in the research process and accurate communication of research findings. This means that the research's findings must represent the meanings of the research respondents and must be authentic and accurate descriptions of the research respondents. I ensured that the descriptions of heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers with regards to differential treatment in the teaching and learning of science and technology subjects were interpreted as accurately as possible. I ensured the presentation of authentic and accurate findings by undertaking the necessary steps to compile thick, detailed and rich descriptions of the respondents' views and experiences of the themes under study. Respondents' views and experiences were captured using semi-structured interview schedules (Appendix 7).

I was able to achieve rigour in this study by managing the risk of research reactivity as well as bias. Shenton (2004:64) and Morrow (2005:252) suggest the following activities, engagements and strategies for managing threats of research reactivity and bias as well as increase the credibility of this study's findings: member checking, thick description, prolonged engagements as well as peer and respondents debriefing. I also adopted these in this study.

4.8.2.1.1 Member checking in qualitative study

Shenton (2004:68) posits that checks relating to the accuracy of data may take place on the spot, in the course, and at the end of the data collection dialogues. Polit and Hungler (2004:433) also emphasise that if researchers are to claim that their reconstructions are recognisable to audience members as adequate representations of their own realities, it is essential that they be given the opportunity to react to them. This implies that respondents may be asked to read the information during and after data analysis to consider if their words match with what they actually intended. The verification of data analysis can be done with selected respondents or returning to a sample of respondents with a draft of the findings to ascertain their sense of agreement with the findings.

In this study, I sought my respondents' feedback by according them an opportunity to confirm whether they were in agreement with the research's findings. Selected heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers checked findings that emerged from the interview data after the themes had already been finalised. The above-mentioned respondents confirmed that the findings were a true reflection or adequate representations of their contributions.

4.8.2.1.2 Thick description in qualitative research

According to Morrow (2005:252), thick descriptions involve detailed, rich descriptions not only of participants' experiences of phenomena, but also the contexts in which those experiences occur. Shenton (2004:69) avers that thick descriptions help to convey the actual situations that have been investigated and, to an extent, the contexts that surround them. Thus, without thick descriptions, it is difficult for the reader of the final account to determine the extent to which the overall findings are credible.

I ensured that thick, detailed and rich descriptions of the views and experiences (Appendix 7) of the participants on the nature of boys' and girls' access to and performance in science and technology subjects at single sex and mixed sex schools were compiled. I also compiled thick, detailed and rich descriptions of the participants' views and experiences in terms of the extent to which society affects the education of boys and girls in science and technology subjects at school. As has been explained earlier, thickness of the descriptions entailed thorough descriptions in line with the participants' experiences as captured during the interview. The use of the voice recorder helped me to compile thick descriptions which rendered this study credible since the information was always available even after the actual interview process.

4.8.2.1.3 Prolonged engagement in qualitative study

Prolonged engagements may be achieved via consultation of appropriate documents and preliminary visits to the organisations to establish a relationship of trust between the researcher and the respondents (Shenton, 2004:65). This means that prolonged engagement gives the researcher enough time not only to learn the culture of the respondents, but also to deal with distortions and build trust with the research respondents. It was imperative for me to spend enough time with respondents because orientation has the propensity to minimise undue attention and overreaction that is likely to be exhibited by respondents if they meet a stranger.

According to Holloway (2005:175), enough time must be spent with respondents to develop a trusting relationship with them during the interviews and member checks. This emphasises the importance of prolonged engagement if the research findings are to be credible. In this study, I went to the two schools and mingled with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers prior to the actual data collection exercise. This way, I managed to familiarise and build trust with my research respondents, thereby minimising undue attention and overreaction that were likely to manifest during fieldwork if I was a stranger.

4.8.2.1.4 Peer and participants debriefing

Morrow (2005:252) suggests the use of peer debriefers or peer researchers to increase the credibility of the qualitative research. Shenton (2004:67) also says through frequent debriefing sessions, the vision of the investigator may be widened as others bring to bear their experiences and perceptions. Similarly, Polit and

Hungler (2004:432) posit that peer debriefing exposes a researcher to the searching questions of others who are experienced in the methods of enquiry, the phenomenon or both.

In this study, I collaborated with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers from the two participant schools. I also engaged in frequent debriefing sessions from my promoters, peer researchers, student advisors as well as colleagues who are in the research field in order not only to widen my vision of the themes, but also to attend to detected flaws as well as biases in this study. This enabled this study to be credible because debriefing sessions from peers and other researchers, including accomplished scholars improved the quality of my interview questions (Appendix 7). Consequently, I was able to collect credible data from respondents with regards to the manner in which society promotes gender disparities in the teaching and learning of science and technology subjects in schools.

4.8.2.2 Transferability in qualitative research

Transferability refers to the extent to which the reader is able to generalise the findings of a study to her or his own context (Morrow, 2005:252). Similarly, Shenton (2004:69) views transferability as the extent to which the readers relate findings of a study to their own positions or situations. Streubert-Speziale and Carpenter (2003:29) point out that transferability, which is also known as fittingness determines whether the findings of a study fit in or are transferable to similar situations. Thus, transferability refers to the probability that the study findings have meaning to others in similar situations.

Streubert-Speziale and Carpenter (2003:29) argue that the potential user, not the researcher, determines whether or not the findings are transferable. It is the responsibility of the researcher to ensure that sufficient contextual information about the fieldwork sites is provided in order to enable the reader to make such a transfer.

In other words, comparison and transfer of findings is possible if the researcher provides a dense description of the research context and sufficient descriptive data that the reader can assess and evaluate its applicability or transferability either to his or her own context or another situation.

I provided a thick and dense description of the participants' views and experiences on how society promotes gender inequalities in the teaching and learning of science and technology subjects in schools. Rich descriptions of the views and experiences of heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers gave the readers of this study an opportunity to consider if the findings could be transferred to their own or other situations. Promoters, peer researchers, student advisors and colleagues also confirmed that the findings had the same meaning as their situations. It was evident from their remarks that the findings of this study were transferable not only to their contexts, but also to other situations.

4.8.2.3 Dependability in qualitative study

The term dependability is a parallel criterion that works to achieve trustworthiness of the qualitative research and as a process through which derived research findings should be explicit and repeatable as much as possible (Morrow, 2005:252). Shenton (2004:71) asserts that in order to address the dependability issue more directly, the processes within the study should be reported in detail, thereby enabling a future researcher to repeat the work, if not necessarily to gain the same results. Thus, dependability is met through securing the credibility of the findings. The implication is that a demonstration of credibility goes some distance in ensuring dependability.

Polit and Hungler (2004:435) emphasises that dependability is the stability of data over time and is obtained with stepwise replication and inquiry audit. Similarly, Holloway (2005:143) states that dependability is related to consistency of findings in that if the study were repeated in a similar context with the same respondents, the findings would be consistent. Thus, in qualitative research, the instruments to be assessed for consistency are the researcher and the respondents. For the findings of the study to be dependable, they should be checked and audited by means of external checks. A more direct technique is the "overlap method" which involves a series of checks.

I ensured that dependability was achieved by compiling thick, detailed and rich descriptions of the participants' views and experiences with regards to factors that influence the differences in performance of boys and girls in science and technology subjects. I also reported the research processes in detail with regards to the manner in which society promotes gender imbalances in the teaching and learning of science and technology subjects in schools. This ensured stability and consistency of data over time if the study were to be repeated in a similar context with the same respondents. Furthermore, I ensured that dependability was achieved by availing the findings to my school-based respondents identified above for auditing. The document's findings were also exposed to peer researchers, student advisors, colleagues and accomplished scholars for advice. My promoters also provided guidance, auditing and examination of the document. Availing the research's findings for external checks enabled readers to ascertain whether the study's findings were repeatable in a similar context with the same respondents. It was evident from their remarks after checking and auditing the document that it was indeed dependable.

4.8.2.4 Confirmability in qualitative research

According to Morrow (2005:252) confirmability is based on the perspective that the integrity of findings lies in the data and that the researcher must adequately tie together the data, analytic processes and findings in such a way that the reader is able to confirm the adequacy of the findings. This view is consistent with that of Shenton (2004:72) who asserts that steps must be taken to help ensure as far as possible that the work's findings are the result of the experiences and ideas of the informants, rather than the characteristics and preferences of the researcher. The purpose of confirmability is to illustrate that the evidence and thought processes give another researcher the same conclusions as in the research context (Streubert-Speziale & Carpenter, 2003:38). Thus, for the research to be said to be confirmable, findings should represent as far as is humanly possible, the situation being researched rather than the beliefs, pet theories or biases of the researcher. From the above definitions, it can be deduced that confirmability is a strategy to ensure neutrality of data and findings and not the researcher's neutrality.

Many of the procedures used to accomplish the goals of dependability, credibility and transferability are also applicable to confirmability (Streubert-Speziale &

Carpenter, 2003:38; Shenton, 2004:72; Morrow, 2005:252). To ensure the accomplishment of confirmability in this study, I collected raw data using my interview schedules (Appendix 7) and the voice recorder, analysed and synthesised it making sure that the conclusions of the study's findings were supported by the gathered data. In consultation with my promoters, peer researchers, student advisors, colleagues as well as this study's school-based respondents, who include heads of schools and teachers, I adhered to prolonged engagements, member checking, peer and participants debriefing as well as transferability. Above all, I took the necessary steps to compile thick, detailed and rich descriptions of the above-named respondents' experiences and views with regards to the manner in which gender socialisation affects the education of boys and girls in science and technology education at school.

4.9 ETHICAL CONSIDERATIONS

Social research is guided by ethics. The term ethics, according to De Vos, Strydom, Fouche and Delport (2005:57) refers to moral principles that are proposed by people and are expected to offer guidelines on expectations of behaviour with regards to conduct towards research participants, sponsors or other researchers. Burton and Bartlett (2009:30) describe ethics as a systematic study of value concepts such as what is good or bad, right or wrong including principles which offer reasons for the application of such concepts. Consistent with the above views is that of Monette, Sullivan and De Jong (2008:45) who define ethics as the study of behaviour that is proper and improper as well as human obligations in research. The above scholars concur that research should rest not only on the trust that researchers should get from participants through observing principles of good practice, but also the responsibilities that researchers should bear towards those who participate in the study. This implies that during research, the researcher is expected to be ethical by following and abiding by ethical guidelines, considerations or principles such as informed consent, confidentiality, anonymity, privacy, protection of participants from harm and the social protocol (Strydom, 2002:63).

4.9.1 Informed Consent

According to Mack, Woodsong. MacQueueen, Guest and Namey (2005:9), informed consent refers to a mechanism for ensuring that people understand what it means to participate in a particular study so that they can decide in a conscious and deliberate way whether they want to participate or not. Similarly, Gajjar (2013:13) stresses that participants must be provided with all the information that might reasonably influence their willingness to participate, including potential risks and benefits. In the same vein, Hardwick and Worsley (2011:33) emphasise that participants must be provided with enough information to enable them to make informed decisions or to participate in the research with full knowledge of what is happening.

As a way of observing the principle of informed consent, I informed the participants using the informed consent document obtained from the University of Venda's Research Ethics Committee (Appendix 5) of my intention to interview, supply them with questionnaires and study their records at least a month before the scheduled day. They were asked to complete and sign the informed consent documents given to them and return them to me before the commencement of the scheduled data gathering process. With regards to minors, their parents were asked to sign the informed consent forms on their behalf. Before signing, I explained to them the purpose of the research, expected time to engage them, their rights to withdraw at any time if they so wished and the benefits of the study to the society at large, including themselves. By doing this, I ensured that all participants voluntarily chose to be involved in the research.

4.9.2 Confidentiality

Confidentiality of the study's findings needs to be upheld by not disclosing the information that participants provide to other people (Maree, 2012:307). Cohen, Manion and Morrison (2000:62) note that the scope involving the knowledge sharing activity has to be protected. According to Monette, Sullivan, De Jong and Hilton (2014:58) confidentiality refers to the idea that the information given by the researcher is not revealed publicly. In view of the above observations, it is fundamental for researchers to ensure that information about data collection from participants in a study is not made public in a way that can be linked to an individual.

To win the confidence of the participants, I assured them that the information they would provide would not be made public but would strictly be used for research purposes. In this way, the principle of confidentiality was adhered to. I also indicated to participants both orally and in writing (Appendix 5) during the study of records as well as interview and questionnaire administration that confidentiality would be strictly observed. Each interview and questionnaire instrument contained a section that spelt out my commitment to observing strict confidentiality.

4.9.3 Anonymity

Anonymity means no one even the researcher has the right to link data to a particular respondent (Monette et al, 2008:56). Cohen et al, (2000:60) posit that the essence of anonymity is to ensure that the identity of research participants is in no way revealed to the public. The two authors concur that the obligation to protect the anonymity of those participating in the study should be fulfilled at all costs unless prior arrangements to the contrary are made with the participants. Thus, anonymity can be accomplished by not including any identifying names or numbers with the data collected.

In this study, I assured all my participants about their anonymity. I verbally informed them that their names would never be revealed. Therefore, there was no need for them to provide their names or those of their schools or institutions. I even indicated to participants in writing (Appendix 5) that anonymity would be strictly observed during document analysis, interviews and questionnaire administration.

4.9.4 Privacy

The right to privacy means that a person has the right not to take part in research, not to answer questions, not to be interviewed, not to have his or her home intruded into, and to engage in private behaviour in their own private space without fear of being observed (Cohen, Manion & Morrison, 2011:90). In the same vein, Hardwick and Worsley (2011:35) emphasise that securing privacy for participants involves ensuring that they are given an opportunity to control if, when, and under what circumstances they reveal or grant access to personal information on their behaviour. The scholars stress that privacy is more than simple confidentiality in that it offers participants the right to total self-determination. This underscores the need for researchers to ensure that the right to privacy is guaranteed on the data that are generated from participants.

Whereas confidentiality is about disclosing the information that participants or respondents provide to other people, privacy entails giving participants or respondents an opportunity to control when, and how to reveal or grant access to personal information (Gallardo, 2012:111). To ensure that the right to privacy was guaranteed on the data collected from participants and respondents, I explained to them that they were in control about the time, place and circumstances to disseminate information that was shared during the research process. would be subjected to privacy and strictly used for research purposes only. I also issued them with consent forms (Appendix 5) which spelt out that privacy would strictly be observed during the data gathering process. They read and signed the consent forms as an indication that they were voluntarily participating bearing in mind that their right to total self-determination in the study was guaranteed. In this way, the principle of privacy was adhered to.

4.9.5 Protection of Participants from Harm

With regards to the principle of no harm to participants, Litchman (2013:52) contends that there should be a reasonable expectation by those participating in a research that they will not be involved in any situation in which they might be harmed. According to Halai (2006:2), the principle of no harm to participants compels researchers to provide participants with an outline of the risks involved to the participants in the study. Fortunately, there were no foreseen risks that were likely to cause harm to participants in this study and participants were made aware of this (Appendix 5).

4.9.6 Social Protocol

The research could not be complete without following the social protocol. I obtained written permission from the University of Venda's Research Ethics Committee (Appendix 2) which I used to get written permission from the Ministry of Primary and Secondary Education Head Office, Provincial Offices and District Offices in Zimbabwe (Appendix 3) before engaging schools for research purposes.

4.10 CHAPTER SUMMARY

This chapter discussed the research paradigm, design and methodology with regards to the extent to which and how gender socialisation affects the education of boys and girls in terms of their access to and performance in science and technology subjects at school. The pragmatic paradigm, which is the middle ground between positivism and interpretivism was the most relevant research paradigm for this study. The mixed methods research design that merges quantitative and qualitative research designs into a single study was adopted. The probability stratified random sampling procedure was used to extract a representative sample of learners for questionnaire administration. The non-probability purposive sampling was also used to come up with a sample of school teachers for interview purposes. While the questionnaire schedule and the document analysis protocol instruments were used to collect quantitative data, the interview guide instrument was employed to gather qualitative data.

Thus, quantifiable data from school documents, questionnaire responses from learners as well as interview responses from teachers enabled the comparison and cross referencing of recurring trends in terms of the nature of access to and performance in science and technology subjects by boys and girls at school.

To ensure validity and reliability of the questionnaire schedule, the instrument was exposed to this study's selected participants who moderated it and ensured that errors were minimised. The chapter also took measures to ensure that the trustworthiness of qualitative research was achieved through member checking, peer and respondents debriefing and spending enough time with respontents to minimise undue attention on the actual data gathering day. Furthermore, thick, detailed and rich descriptions of respondents' views and experiences were compiled to ensure the findings were authentic, accurate, credible and transferrable to other people's contexts or situations. Ethical considerations which ensured the smooth flow of the research process were adhered to.

CHAPTER FIVE

DATA PRESENTATION AND ANALYSIS

5.1 CHAPTER INTRODUCTION

This study sought to determine and explore factors that influence access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools in Zimbabwe. This chapter presents and analyses quantitative data gathered through questionnaire schedules and the schools' ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results documents as well as qualitative data gathered through interviews. After presenting data from questionnaires and school documents using chi-square and binomial tests, descriptive and inferential statistical analysis were then employed to draw conclusions from gathered quantifiable data with regards to the nature of boys' and girls' access to and their performance in science and technology related subjects at single sex and mixed sex schools. In this study, I personally administered the questionnaire guides (Appendix 6) with closed ended questions to a total of 193 randomly selected form 1-6 learners at a single sex school and a mixed sex school.

The mixed sex school sample comprised of 112 learners. Of these 53 were boys while 59 were girls. The sample at the single sex school consisted of 81 learners.

Narrative data collected from interviews (Appendix 7) were interpreted using content analysis. Individual face to face interviews were conducted with 44 purposively sampled teachers from the two study sites. The qualitative sample at the mixed sex school comprised of 23 teachers. These consisted of 1 head of school, 1 deputy head, 2 science and technology subjects HODs, 11 science and technology subjects class teachers and 8 science and technology subject teachers. The qualitative sample at the single sex school consisted of 21 teachers. These comprised of 1 head of school, 1 deputy head, 2 science and technology subject HODs, 10 science and technology subjects class teachers and 7 science and technology subject teachers. Qualitative data analysis was based on themes and patterns (Table 5.7) that emerged from the data as I sought respondents' views on how gender socialisation affects the education of boys and girls in science and technology subjects at school.

Quantifiable data from questionnaires and school documents as well as qualitative data from teachers' interview responses enabled the comparison and cross referencing of recurring trends in terms of society's influence on the education of boys and girls in science and technology subjects at school.

5.2 DATA ANALYSIS PROCEDURE

This section presents the analysis of quantitative and qualitative data. Quantitative data for this study was collected from questionnaires and school documents. The school documents were the ZIMSEC, 2016 – 2017, 'O' and 'A' Level final national examinations results from the single sex school and the mixed sex school selected for the study. Chi-square and binomial test results which measured the presence or absence of any significant differences in access to and performance of boys and girls in science and technology subjects were derived from collected data.

Statistical tests compared access and performance of girls at a single sex and a mixed sex school as well as boys and girls learning together at a mixed sex school. The tests also compared access and performance of boys at a mixed sex school and girls at a single sex school. Access and performance results from questionnaires which were based on learners' perceptions formed the first part of the statistical analysis. These were followed by access and performance findings from school documents. Access and performance findings from both questionnaires and school documents were intended to address the three quantitative objectives of the study namely:

- To establish if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- To determine if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.

- To establish if there is any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at a mixed sex school.

Qualitative data gathered through interviews were narrative in nature and were interpreted using content analysis. The analysis was hinged on themes and patterns derived from data as I solicited respondents' actual or quoted views on factors that could influence the education of boys and girls in science and technology subjects at school. The qualitative objective of the study sought to explore factors that influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

5.2.1 How the Chi-square Test was used

The chi-square test was used to establish if there was any significant difference in access to and performance in science and technology subjects between girls in a single sex school and their counterparts in a mixed sex school. Again, a comparison of boys and girls learning together at a mixed sex school as well as boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of their access to and performance in science and technology subjects at school.

With regards to the comparison between single sex school girls and their counterparts in a mixed sex school, I extracted the levels of significance based on school type. Thus, I used the chi-square tests to determine if there was any statistical difference in learners' access to and their performance in science and technology subjects by school type. A comparison of boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of learners' access to and their performance in science and technology subjects by gender or school type. A comparison of boys and girls learning together at a mixed sex school was done to determine if there was any statistical difference in learners' access to and their performance in science and technology subjects by gender.

In some instances, statistical results showed that there was an association or significant difference in access to and performance by gender or school type when the percentage value (p-value) was less than 0.05 ($p<0,05$) (Diener-West, 2008:15; Kostalova, 2010:165; Hanlon & Larget, 2011:68). This means that gender or school type played a role in learners' access to and their performance in the subjects. In light of this, the null hypothesis which claimed no significant difference in learners' access to and their performance in the subjects by gender or school type was rejected. In other words, the results indicated that gender or school type played a role in determining whether learners passed or failed science and technology subjects at 'O' and 'A' Levels.

In other instances, chi-square results depicted no association or significant difference in learners' access to and their performance in science and technology subjects by gender or by school type. This happened when the percentage values (p-values) were more than 0.05 (level of significance) ($p>0,05$) (Diener-West, 2008:15: Kostalova, 2010:165; Hanlon & Larget, 2011:68). This implies that learners' access to and their performance in the subjects was not in any way associated with whether they were males or females. It also implied that learners' access to and their achievement in science and technology subjects was not in any way associated with whether they were from a single sex or a mixed sex school. Thus, the chi-square tests were done to show the magnitude of differences in learners' access to and their performance in science and technology subjects by gender or by school type (Diener-West, 2008:15: Kostalova, 2010:165).

In this study, I used the chi-square test on the data derived from questionnaires which were administered to 193 learners from a single sex school as well as a mixed sex school. Extracted data on learners' perceptions were used to answer the three quantitative objectives of the study. With regards to the ZIMSEC 2016 – 2017, 'O' and 'A' Level final examinations results, the chi-square was used to calculate the significant difference in terms of the performance part only since the access aspect was calculated using the binomial test. It was difficult to calculate the access part of the three quantitative objectives using the chi-square test, hence my decision to use the binomial test which was the most convenient one to generate the desired results for the study.

5.2.2 How the Binomial Test was used

The binomial test was used to establish the presence or absence of any significant differences in access to science and technology subjects by learners in a mixed sex school and those in a single sex school. A comparison was done between girls in a single sex school and their counterparts in a mixed sex school. The purpose was to establish if there was any significant difference in terms of learners' access to science and technology subjects based on the school type.

Another comparison of boys and girls learning together at a mixed sex school was done to determine if there was any statistical difference in learners' access to science and technology subjects by gender. Again, a comparison of boys in a mixed sex school and girls in a single sex school was undertaken to determine the presence or absence of any significant difference in terms of learners' access to science and technology subjects by school type or gender.

The binomial test for proportion was employed to test if either of the proportions were equal to 0.5. According to the test, if we can prove that the proportion of learners from one gender is not equal to 0.5, it would be sufficient to observe the differences that exist in terms of accessibility to science and technology subjects (Caffo, 2007:10). According to Hanlon and Larget (2011:15) the binomial test is a two-tailed test used to establish if access is equal by gender or school type. To test the hypothesis, we say: Proportion (**p**) is equal to 0.5 versus a two-sided alternative hypothesis to prove that the proportion is equal or not equal to 0.5 (Hanlon & Larget, 2011:15). Thus, using the binomial test, we assume that if access to science and technology subjects by school type is equal, we would expect the proportion of females in a mixed sex school and those in a single sex school to be equal and hence sum up to unity 1 (Smit & Ross, 2005:31).

When, for instance, we note that the proportion of the two variables being compared, that is, the number of single sex school girls and that of mixed sex school girls do not sum up to unity 1, then we know that there is need for further tests to establish the magnitude of difference (Smit & Ross, 2005:31). If statistical results show that there is significant difference between the two variables being compared, the percentage value (p-value) would be less than 0.05 (p<0,05) (Diener-West, 2008:15). This implies that learners' access to science and technology subjects was associated with the school type or gender. On the other hand, if statistical results show that there is no significant difference between the two variables being compared, the percentage value (p-value) would be more than 0.05 (p>0,05) (Caffo, 2007:10). This means that learners' access to science and technology subjects was not in any way associated with school type or gender. This implies that, statistical tests give us 95% confidence that the two variables being compared are almost equal and the differences (if any) are insignificant to talk about.

In this study I used the binomial test to answer the access aspect of the three quantitative objectives, which sought to establish if there was any significant difference in access to science and technology subjects between boys and girls learning together at a mixed sex school, using the ZIMSEC 2016 – 2017, 'O' and 'A' Level final examinations results. A comparison of girls in a single sex school with both boys and girls who are learning together in a mixed sex school was also undertaken. I opted to use the binomial test for the access part of the three quantitative objectives using school documents because it was the most convenient test which generated the desired results for the study. Other statistical tests were done using the chi-square.

5.3 QUANTITATIVE DATA ANALYSIS

Data obtained from the 193 questionnaire respondents comprising of 53 boys and 59 girls from the mixed sex school as well as 81 girls from the single sex school sought learners' perceptions on the influence of parents, the school, media and peers on boys' and girls' access and performance in science and technology subjects. Data from questionnaires also solicited learners' perceptions with regards to their own access to and performance in science and technology subjects. The questionnaire had 18 questions (Appendix 6) and out of these only three were subjected to the chi-square tests to determine the presence or absence of any significant difference with regards to boys' and girls' access to and their performance in science and technology subjects at the single sex and the mixed sex school. I opted to use the three questions because the questioning technique enabled me to answer my research questions as well as respond to the study's hypotheses easily and objectively. However, it is imperative to point out that all 18 questions were the first to be statistically analysed using graphs before the three were selected for chi-square tests.

They generated data on learners' perceptions with regards to the influence of the home, school, peers and the media on boys' and girls' access to and their performance in science and technology subjects. Percentages in the graphs were rounded up or down to the nearest whole number. Others were rounded up or down to one decimal point. All data from questionnaires were subjected to descriptive statistics. Quantitative data analyses for this study were executed using the Statistical Package for the Social Sciences (SPSS v 23.0) and Microsoft Excel 2010.

5.3.1 Influence of Parents, School, Media and Peers

This section presents and discusses learners' perceptions on influence of parents, the school, media and peers on boys' and girls' access and performance in science and technology subjects. It also presents learners' perceptions on their own access and performance in science and technology subjects. The section starts by presenting the access part followed by the performance aspect.

I was interested in getting the perceptions of a sample of 193 randomly sampled questionnaire respondents comprising of 53 boys and 59 girls from the mixed sex school as well as 81 girls from the single sex school separately. Some closed ended questionnaire items were structured in a way that enabled them to be answered by only boys and girls learning together at the same school while one was meant to be responded to by single sex and mixed sex school female learners. This was meant to ensure that questions peculiar to the two groups of learners being compared were answered. The other reason was to ensure that questionnaire items were addressing access and performance aspects of the three quantitative objectives adequately. However, my objective to enable the entire quantitative sample of 193 learners respond to the bulk of the questionnaire items for the study was achieved.

In presenting data for the different questionnaire items on both access and performance aspects, I collated the strongly agree and agree together and presented them as respondents who agreed to a given statement and did the same for those who disagreed. For each graph's heading, I wrote the question as it was in the questionnaire instrument to make the "agree" and "disagree" responses during data analysis make sense.

5.3.1.1 Access to science and technology subjects: learners' perceptions

In presenting data on the access part of the quantitative objectives, I was interested in the learners' views on the influence of parents, the school, media and peers on boys' and girls' access to science and technology subjects. I was also interested in soliciting their views with regards to their access to science and technology subjects. It is important to note that these were just perceptions which were meant to be corroborated or compared with the actual access results from statistical calculations.

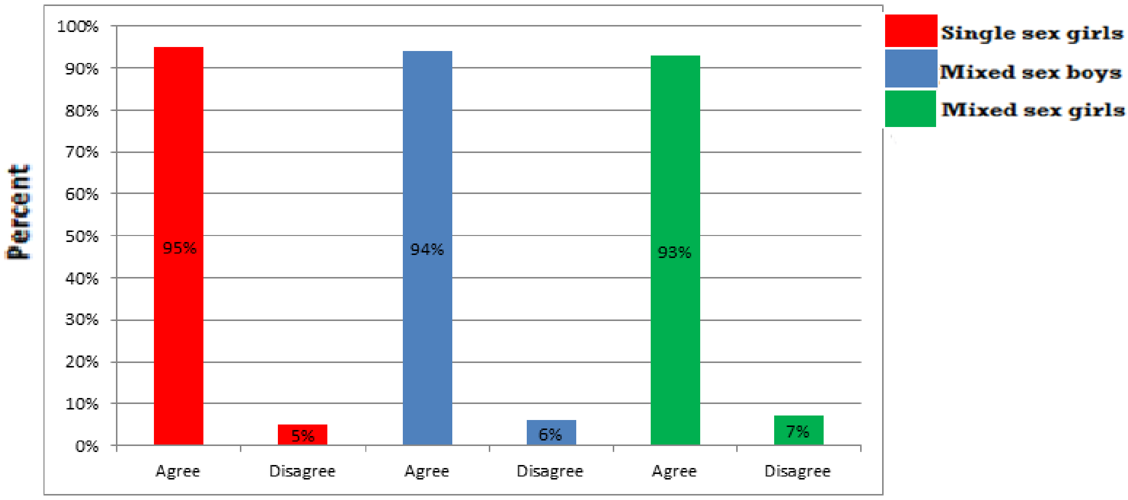

Figure 5.1: My Parents Give Work to do at Home Based on Gender

Figure 5.1 sought to find out the perceptions of 81 girls from the single sex school, 53 boys from the mixed sex school as well as 59 female learners from the mixed sex school on whether parents gave them work to do on the basis of their gender. At the single sex school, data indicate that the majority of the respondents 77/81(95%) agreed while the remaining 4/81(5%) disagreed to the statement. The majority of boys 50/53(94%) at the mixed sex school were also in agreement with the statement while few 3/53(6%) disagreed. In relation to single sex school girls and mixed sex school boys, more girls 55/59(93%) at the mixed sex school believed that boys perform better than girls in science and technology while a minority 4/59(7%) did not feel the same.

The views above depict that more learners from all the three categories being compared concurred that the home environment is not gender neutral when it comes to giving tasks to boys and girls. What can be noted from learners' perceptions is that parents play a role in influencing subject choices by learners along gender lines. Giving children work to do basing on whether one is a boy or a girl implies that parents view boys and girls differently in terms of their abilities and that tends to be the source of inequalities in terms of boys' and girls' access to science and technology subjects at school.

Earlier studies affirm that the socialisation of gender within the family limits women's access to science and technology subjects at school (Molla, 2016:4).

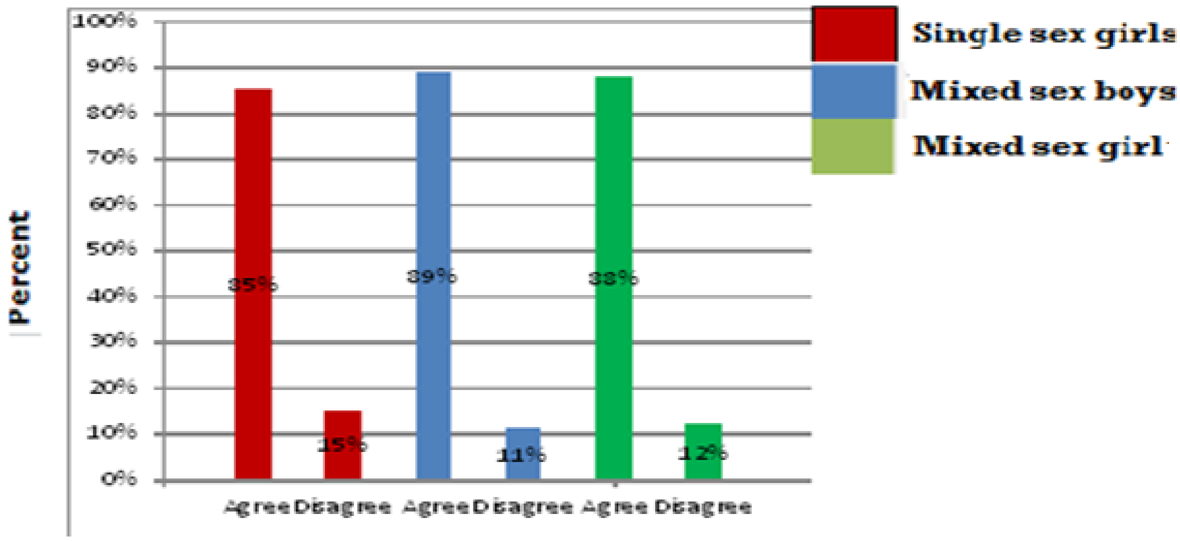

Figure 5.2: I Discuss the Subjects I Pursue at School with my Parents

Figure 5.2 shows that whereas 69/81(85%) of the single sex school female learners agreed that they discuss the subjects they study at school with their parents, 12/81(15%) did not agree. Of the total number of boys from the mixed sex school, 47/53(89%) agreed with the statement that they discuss the subjects they study at school with their parents while the remaining 6/53(11%) disagreed. We also observe that 52/59(88%) of the total number of girls from the mixed-sex school supported the view that they discuss the subjects they study at school with their parents while the remaining 7/59(12%) were not in agreement with the statement. What can be derived from learners' perceptions is that parents play an active role in learners' subject choices at school. Thus, through discussions, the tendency by parents to influence their children to either pursue science and technology subjects or drop them out cannot be ruled out. The family can therefore, be said to possess considerable influence in either promoting or limiting learners' access to certain subjects at school including science and technology.

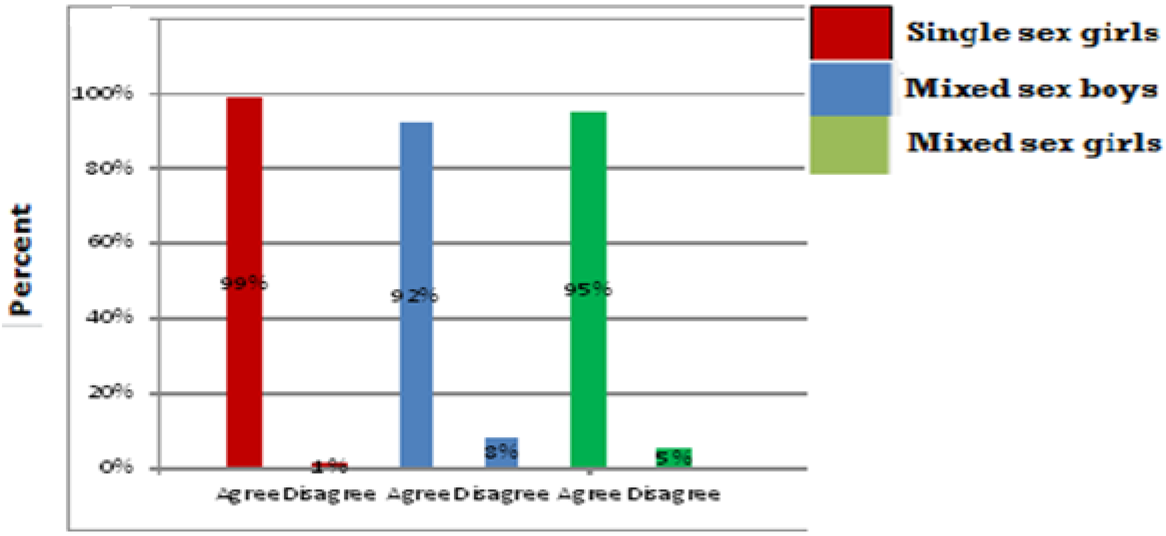

Figure 5.3: My Parents Encourage me to Study Science and Technology Subjects

Findings indicate that the majority of single sex school girls 80/81(99%) compared to 1/81(1%), mixed sex school boys 49/53(92%) compared to 4/53(8%) and mixed sex school female learners 56/59(95%) compared to 3/59(5%) agreed that their parents encourage them to study science and technology subjects at school (Figure 5.3). A larger number of learners who are in support of the statement per category of learners being compared depicts that parents provide an impetus for their children to study science and technology among other subjects taught at school. In other words, the majority of learners reported that parents did not curtail their access to science and technology subjects at school.

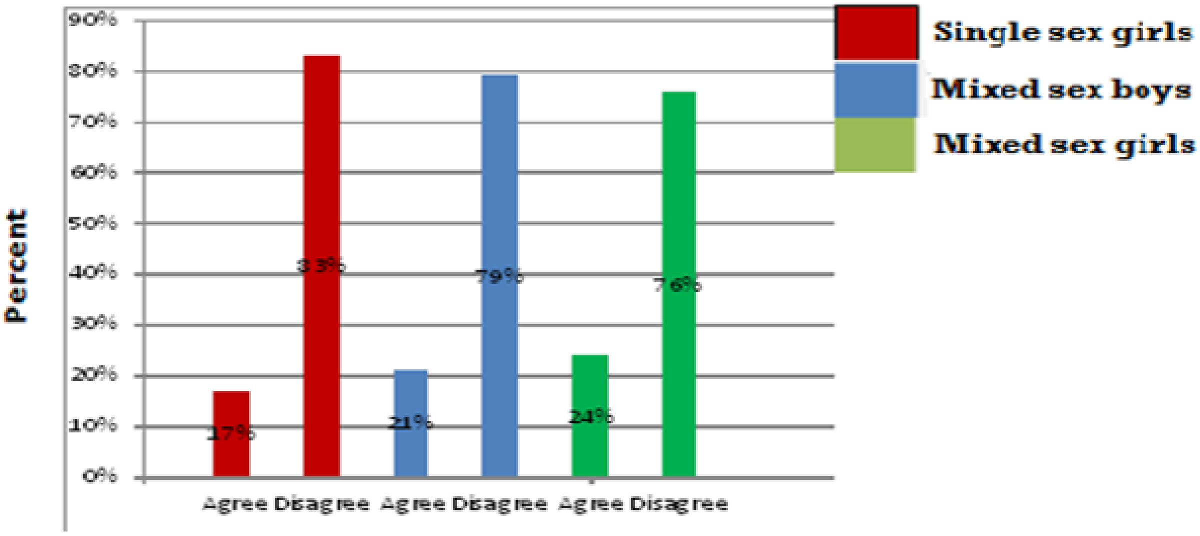

Figure 5.4: My Parents Choose the Career I would Like to do in Future

Data indicate that the minority of the respondents at a single sex school 14/81(17%) agreed with the statement that their parents choose the jobs they would like to do in future while the majority 67/81(83%) disagreed. A minority of the boys 11/53(21%) at a mixed sex school were also in agreement with the statement while more learners 42/53(79%) disagreed. Again, few girls 14/59(24%) at the mixed sex school were disagreed with the statement while the majority 45/59(76%) were affirmative. Results show that parents have little interference in learners' career choices. This means that learners have autonomy to choose subjects that enable them to pursue careers of their choices.

From these results, we can conclude that learners' access to subjects including science and technology is, to a larger extent not curtailed by parents.

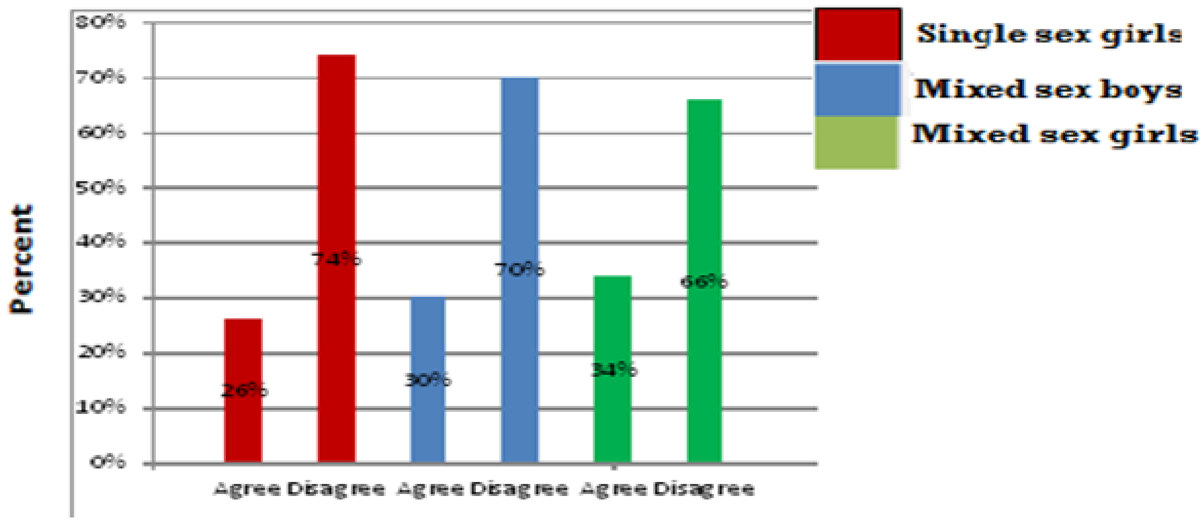

Figure 5.5: Of all the Subjects Offered at our School, my Parents have Told me to Study some and Leave some

It is evident that few single sex school female learners 21/81(26%) agreed with the view that their parents told them to study some of the subjects offered at their school and leave others while the majority 60/81(74%) disagreed (Figure 5.5). In the same vein, minority boys' opinions at the mixed sex school 16/53(30%) were affirmative to the statement while a majority 37/53(70%) disagreed. Results also show that, a smaller number 20/59 (34%) of mixed sex school girls were in agreement with the statement while the majority 39/59(66%) were in disagreement. Data indicate that learners from the three groups whose views are being compared perceive parents to be of little influence on their choice of subjects including science and technology.

Thus, learners feel that parents do not contribute much to girls' or boys' under-representation in certain subjects at school including science and technology.

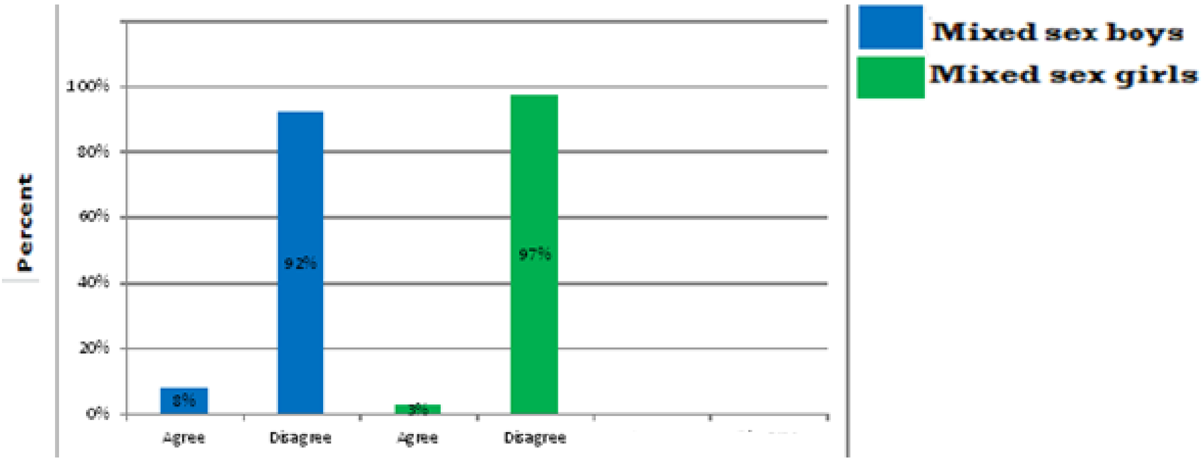

Figure 5.6: Teachers at this School Advise us to pursue Different Subjects According to Gender

This questionnaire item had only two categories of learners being compared namely; boys and girls learning together at the same school. From the graph, we observe that very few female learners 2/59(3%) agreed that teachers at their school advise them to do different subjects according to whether they are boys or girls while most of them 57/59(97%) disagreed. The scenario is the same with boys whose minority 4/53(8%) agreed with the statement while the majority 49/53(92%) disagreed. From the results, both boys and girls affirm that teachers have insignificant influence in terms of boys' and girls' access to science, technology and other subjects taught at school.

On this aspect, we can conclude that teachers have very little influence on boys' and girls' differential access to science, technology and other subjects which are taught at school.

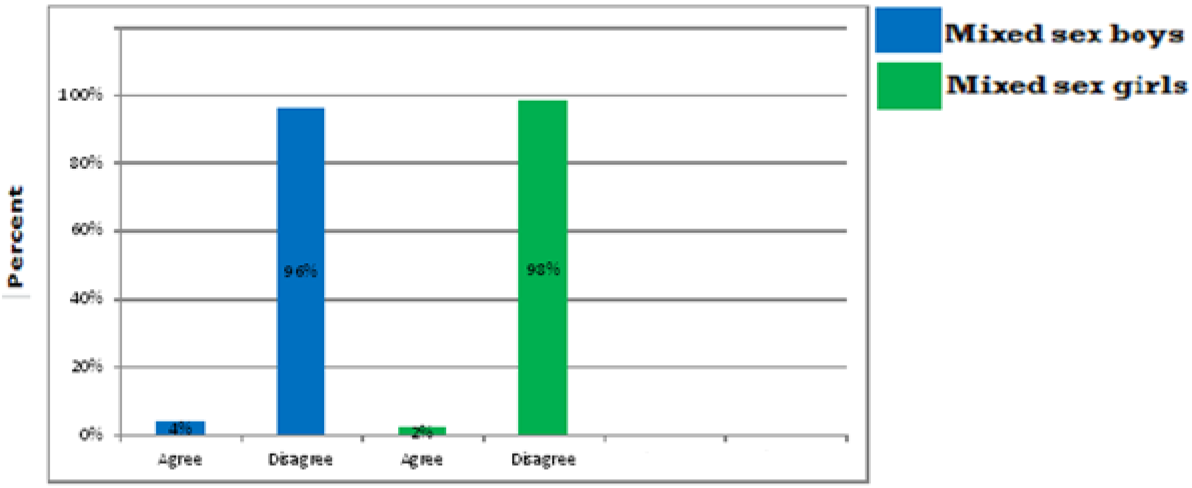

Figure 5.7: Teachers at this School Help us to Choose our Future Careers According to Gender

Only 3/53(4%) of the mixed sex school male respondents believed that teachers at their schools help them to choose their future jobs according to whether they are boys or girls. The majority, 50/53(96%) did not feel the same. Data from the graph also indicate that the minority 1/59(2%) of mixed sex school female respondents felt that teachers at their schools help them to choose their future jobs according to whether they are boys while the majority 58/59(98%) did not share this view. This means that teachers do not regard gender as a factor when helping learners to choose their future jobs.

By not considering gender when assisting learners with career choices, teachers can be said to be largely gender sensitive on this aspect. It therefore, means that teachers do not promote gender inequalities in terms of boys' and girls' access to science and technology subjects at school.

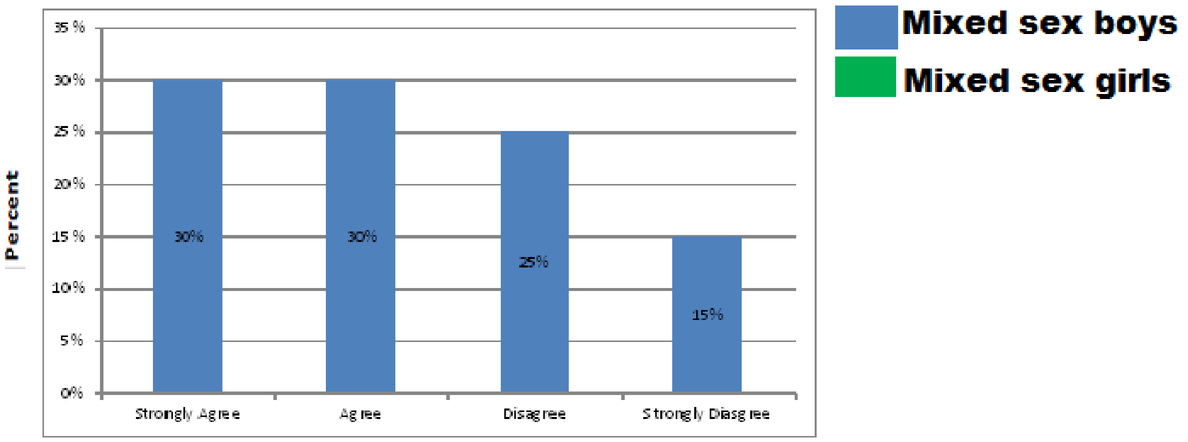

Figure 5.8: Our Teachers Make Efforts to Ensure that all Boys and Girls have Equal Chance to Study Science and Technology Subjects

From figure 5.8 above, we observe that 57/59(97%) of the total number of mixed sex school female learners supported the view that their teachers make efforts to ensure that all boys and girls have equal chance to study science and technology subjects while the remaining 2/59(3%) did not agree with the statement. Like girls, more boys 52/53(98%) at the same school agreed to the statement while the remaining 1/53(2%) disagreed. There is an indication from the majority of learners' perceptions that teachers are gender neutral when it comes to ensuring that all boys and girls have equal chance to study science and technology subjects.

It therefore, depicts that, teachers are to a greater extent, gender sensitive on this regard. These findings contradict a study by Marinova (2003:3) which found teachers to be the main culprits in propagating patriarchal ideologies.

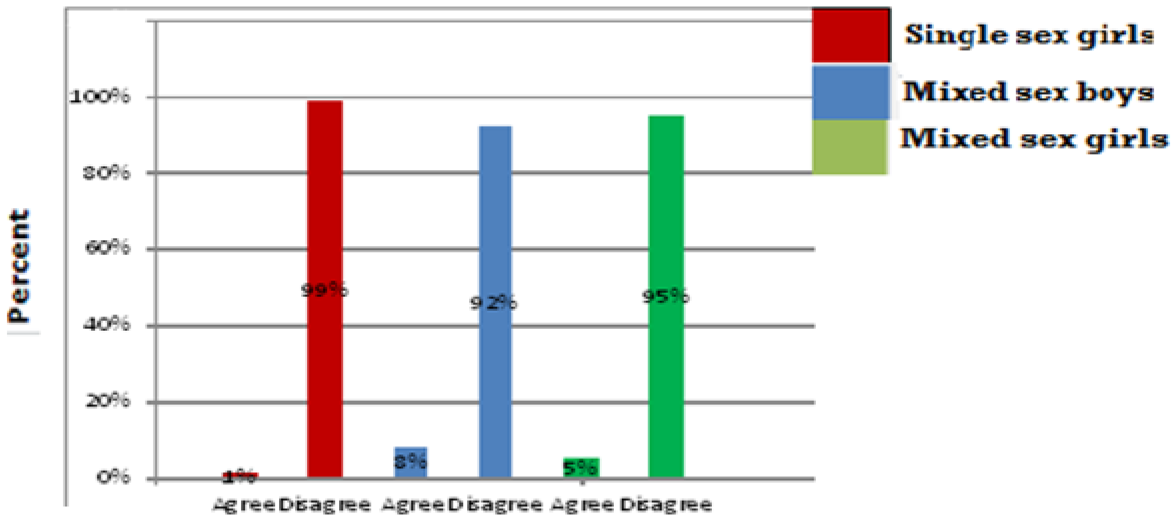

Figure 5.9: Science and Technology Careers/Jobs are Best Suited for Boys than Girls

Few girls from a single sex school (1/81(1%) agreed with the statement that science and technology jobs/careers are best suited for boys than girls while the majority80/81(99%) disagreed. We also note that 4/53(8%) of the total number of boys from the mixed-sex school supported the view while the remaining 49/53(92%) disagreed.

Like the two groups of learners above, few girls from the mixed sex school, 3/59(5%) were in agreement with the statement while the majority 56/59(95%) disagreed. This means that learners believe that boys and girls must access science and technology subjects at the same level since the popular perception is that there are no science and technology careers or jobs that are best suited for a particular gender. In view of learners' perceptions with regards to their own access to science and technology subjects, they can be regarded as largely gender neutral in this respect.

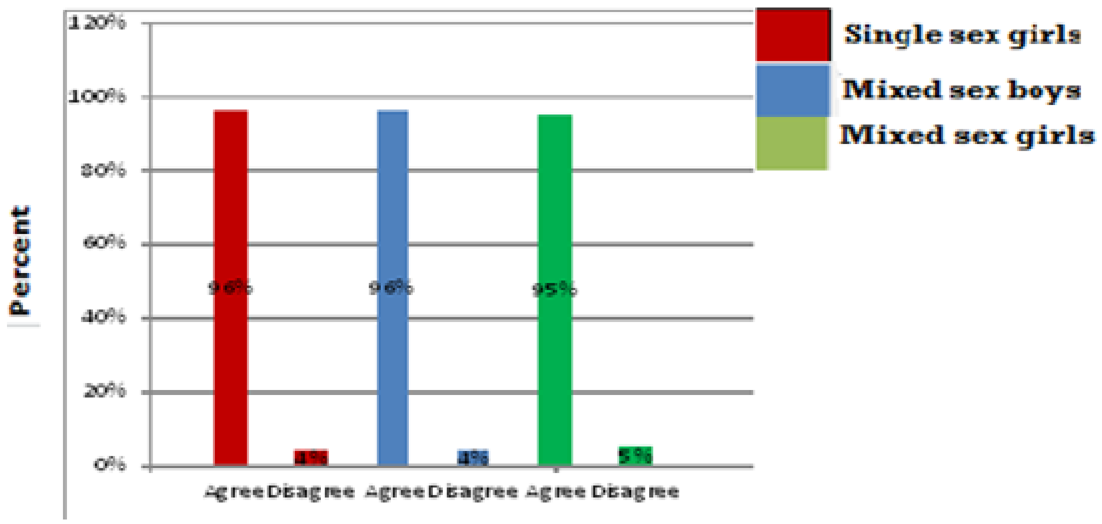

Figure 5.10: Given a Chance, I will Study Science and Technology Subjects

The majority of single sex school respondents, 74/81(91%) indicated that they would study science and technology subjects if they were given an opportunity while fewer, 7/81(9%) had a contrary view. Data also indicate that more mixed sex school boys 51/53 (96%) showed willingness to study science and technology subjects if an opportunity arose while the minority 2/53(4%) did not feel the same.

Again, a popular perception among girls at the mixed sex school girls who are willing to study science and technology subjects if they are given an opportunity 56/59(95%) is evident (Fig 5.10) while a minority 3/59(5%) had a contrary view. These results clearly show that the majority in all the three categories of learners have the zeal to pursue science and technology subjects at school. This brings us to the conclusion that if ever there may be under-representation of a particular gender in science and technology subjects, certain factors which need to be explored further might have played a role.

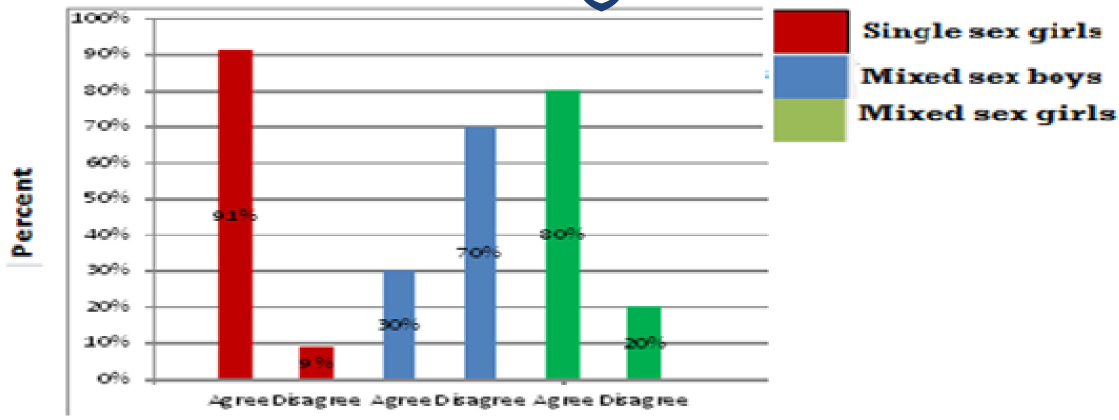

Figure 5.11: There are Science and Technology Subjects that I Wanted to Pursue but are not Offered at our School

A total of 74/81(91%) female respondents at the single sex school, agreed with the statement that there are science and technology subjects they wanted to study but were not taught at their school while the remaining 7/81(9%) disagreed with this statement. Again, the majority of the mixed sex school girls 47/59(80%) reported that there are science and technology subjects they wanted to study but were not taught at their school while 12/59(20%) disagreed with the statement. On the other hand, only 16/53(30%) mixed sex school boys were of the view that there are science and technology subjects they wanted to study but were not taught at their school while the majority 37/53(70%) had a contrary view. From the three categories of learners, we note that more boys were contended with the science and technology subjects taught at their school compared to girls. The figures depict that the general view among female learners at the two schools was that their schools were not teaching some of the subjects which are within this study's scope. As a matter of fact, they perceived their schools as having a limiting factor with regards to their access to science and technology subjects. This means that the two schools were denying female learners of an opportunity to access or study certain science and technology related subjects. It is against this background that schools can be viewed as agents for gender inequality in terms of boys' and girls' access to science and technology subjects.

5.3.1.2 Performance in science and technology subjects: Learners' perceptions

This section presents data on learners' perceptions of boys' and girls' access to science and technology subjects. Learners' views enabled the comparison and cross referencing of recurring trends with the actual performance results from statistical calculations.

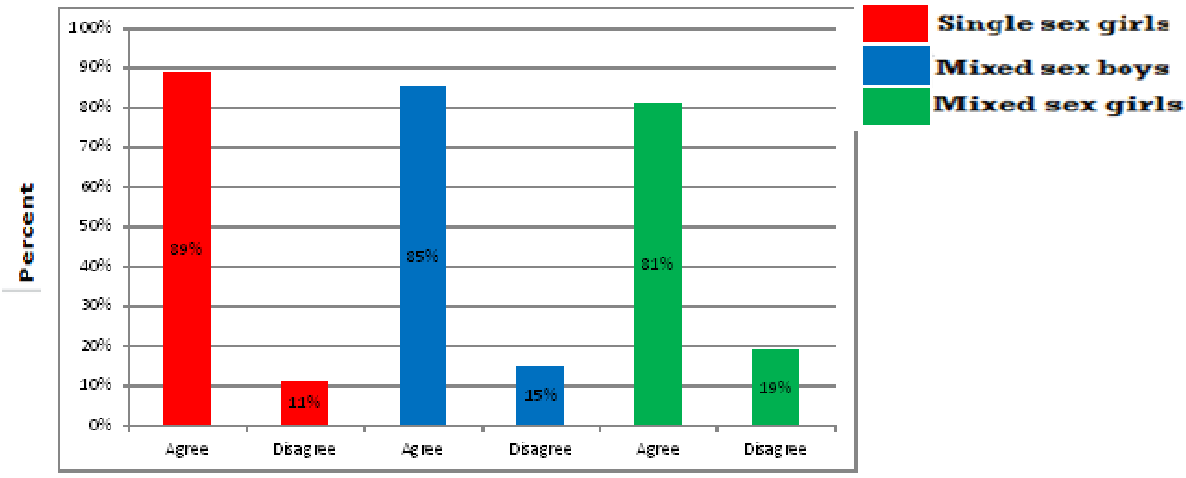

Figure 5.12: Parents Attitudes and Expectations at Home can Influence Boys and Girls to Perform Differently at School in Science and Technology Subjects

The majority of learners from the three categories being compared namely, single sex school girls, mixed sex school boys as well as mixed sex school girls supported the view that parents' attitudes and expectations at home can influence boys and girls to perform differently in science and technology subjects at school. The figures depict that the majority of learners were in support of the view while the minority disagreed with the statement; 72/81(89%)-9/81(11%), 45/53(85%)-8/53(15%) and 48/59(81%)-11/59(19%) respectively. Most learners perceive parents as playing a role in influencing boys and girls to perform differently in science and technology subjects. Thus, the home environment through parents' attitudes and expectations of boys and girls creates an uneven playing field in terms of their performance in science and technology subjects. As a result, one gender tends to work harder and perform better than the other in science and technology subjects.

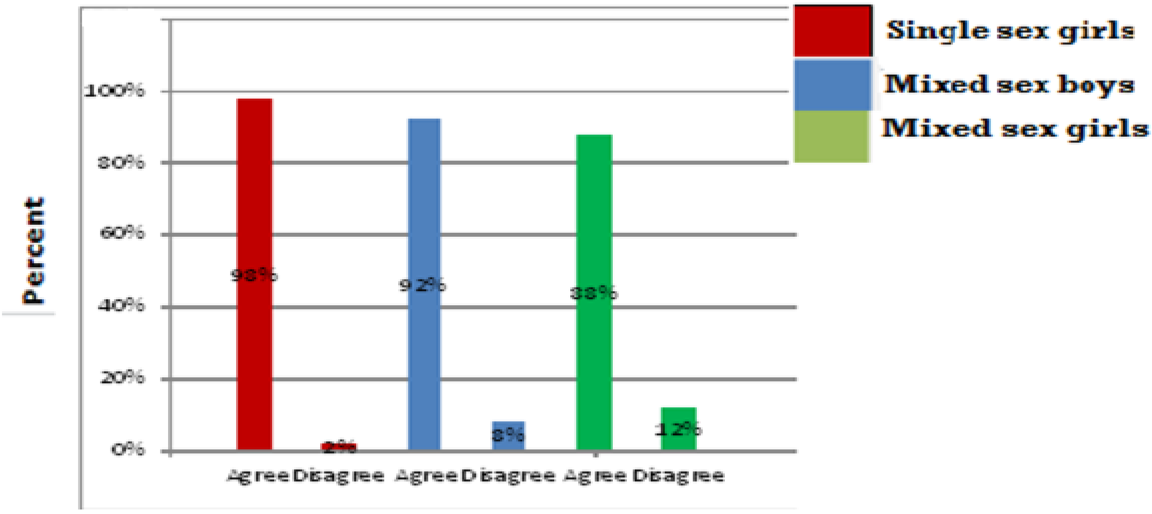

Figure 5.13: The Family, Friends, Media and the School Environment Influence Boys and Girls to Perform Differntly in Science and Technology Subjects

The question on Figure 5.13 sought to find out opinions of 81 female learners from a single sex school, 53 male learners from a mixed sex school as well as 59 female learners from a mixed sex school on whether the family, friends, media and the school environment influence boys and girls to perform differently in science and technology subjects. At the single sex school, results show that the majority of the respondents 79/81(98%) agreed while the remaining 2/81(2%) disagreed with the statement. The majority of boys 49/53(92%) at the mixed sex school were also in agreement with the statement while the minority 4/53(8%) disagreed. Again, more girls 52/59(88%) at the mixed sex school believed that boys perform better than girls in science and technology while the remaining 7/59(12%) did not agree. The popular perception is that socialising agents can result in differential performance in science and technology subjects at school. They have propensity to create a gendered social world, thereby influencing boys and girls to perform differently in science and technology subjects at school.

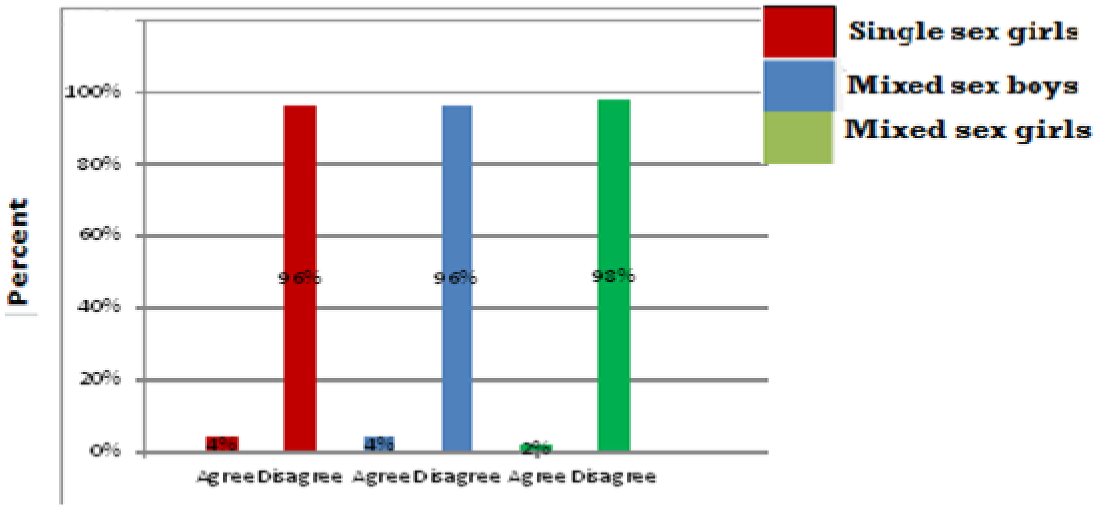

Figure 5.14: Jobs/Tasks that Teachers Expect Boys and Girls to do Affect their Performance in Science and Technology Subjects

In Figure 5.14, we observe that 3/81(4%) of the total number of single sex school female respondents supported the view that jobs or tasks that teachers expect boys and girls to do affect their performance in science and technology subjects while the majority 79/81(96%) did not agree with the statement. Few boys 2/53(4%) at the mixed sex school were also in agreement with the statement while the majority 51/53(96%) disagreed. The trend is the same with regards to single sex school girls where few 1/59(2%) supported the statement and the majority 58/59(98%) were in disagreement. From available data, we note that the majority of learners who participated in the survey did not believe that jobs or tasks that teachers expect boys and girls to carry out affect their performance in science and technology subjects. In view of the learners' perceptions with regards to tasks, teachers have very little influence on learners' differential performance in science and technology subjects at school.

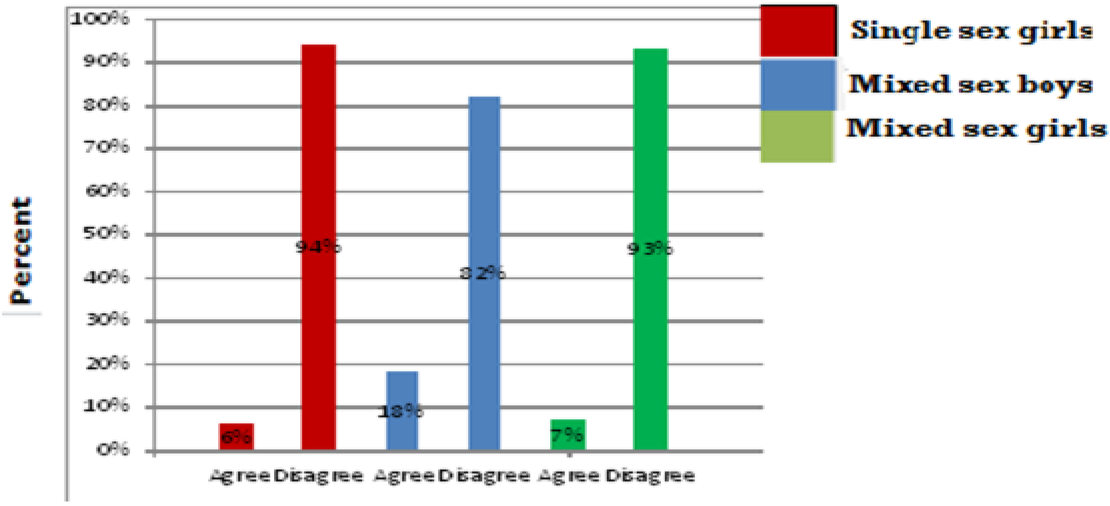

Figure 5.15: There are some Subjects which Boys are Expected to Perform Better than Girls at School

The question on Figure 5.15 sought to find out whether there were some subjects which boys are expected to perform better than girls at school. The minority of single sex school girls 5/81(6%)-76/81(94%), mixed sex school boys 10/53(18%)-43/53(82%) and mixed sex school girls 4/59(7%)-55/59(93%) did not agree with the statement. Data shows more learners from the three groups of learners being compared felt that boys' performance is the same as that of girls in science and technology subjects. They seem to believe that performance has nothing to do with gender. It therefore, means that learners do not expect boys and girls to perform differently even in science and technology subjects.

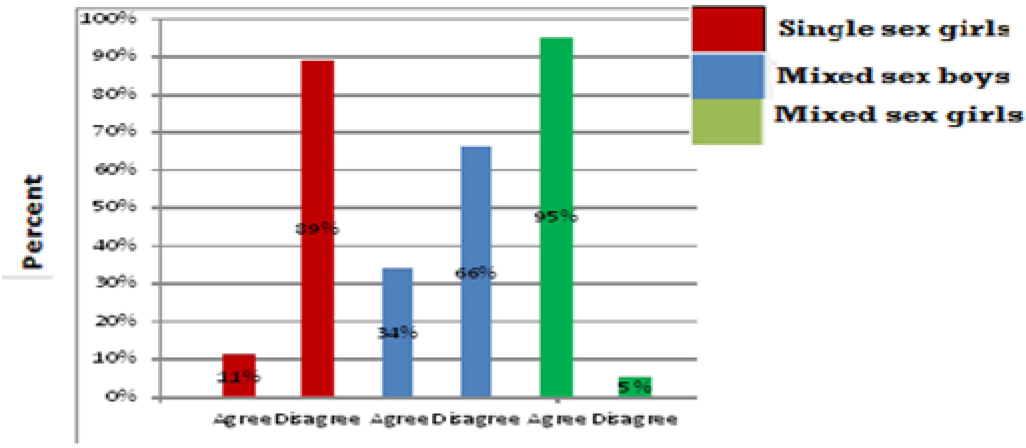

Figure 5.16: Boys Perform Better than Girls in Science and Technology Subjects

Figure 5.16 indicates that 56/59(95%) of girls from the mixed sex school believed that boys performed better than girls in science and technology while the minority 3/59(5%) disagreed. Of the total number of male respondents from mixed sex school, 18/53(34%) agreed with the statement that boys perform better than girls in science and technology subjects while the remaining 35/53(66%) disagreed. With regards to single sex school female learners, only 9/81(11%) reported that boys perform better than girls in science and technology subjects at school while 72/81(89%) of the learners disagreed with the statement. This means that the majority of single sex school girls as well as mixed sex school boys felt that boys' performance in science and technology subjects at school is the same as that of girls. Only mixed sex school girls believed that that boys perform better than girls in science and technology subjects at school. While boys may be influenced by the gender role socialisation to perceive themselves as superior to girls in terms of performance in science and technology subjects, mixed sex school girls' inferiority mentality might have been necessitated by gender competition they are exposed to. Single sex school girls' confidence is boosted because they compete on their own.

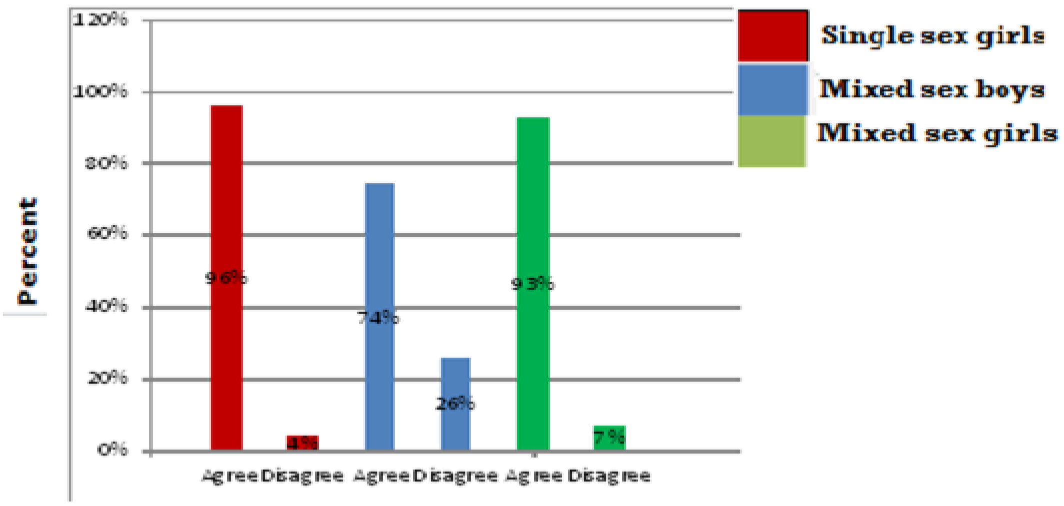

Figure 5.17: Performance in Science and Technology Subjects has Nothing to do with Gender

Whereas 78/81(96%) of the single sex school female learners felt that performance in science and technology subjects has nothing to do with whether someone is a boy or a girl, 3/81(4%) had a contrary view. More boys from a mixed sex school, 39/53(74%) agreed with the statement while the remaining 14/53(26%) disagreed. We also note that the majority of girls from a mixed-sex school 55/59(93%) supported the view while the remaining 4/59(7%) disagreed with this view. Figures depict a popular view from learners that performance in science and technology subjects has nothing to do with whether someone is a boy or girl. Thus, more learners felt that boys' performance is the same as that of girls' in science and technology subjects. This implies that there is no differential performance between the two genders.

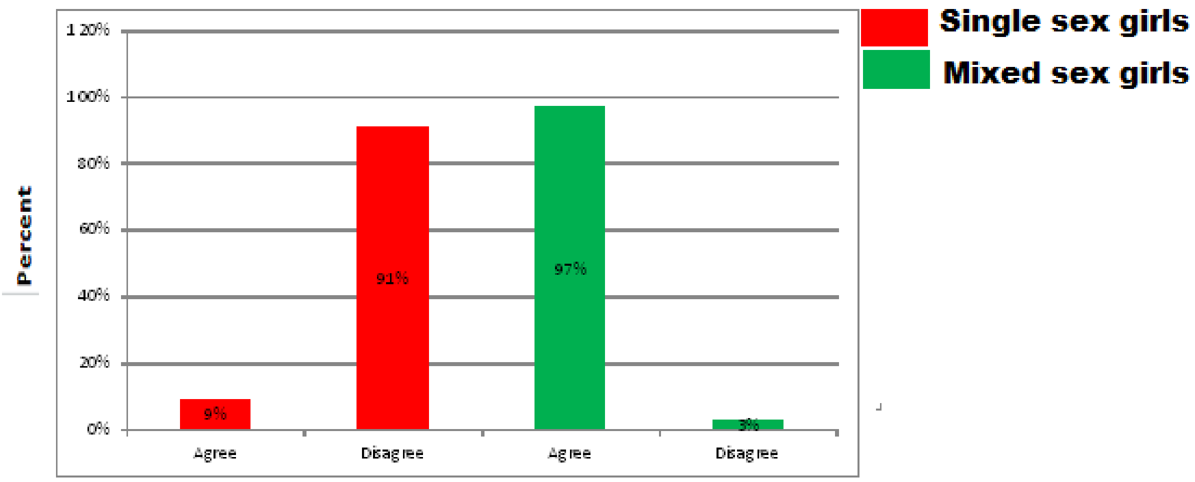

Figure 5.18: Performance of Mixed Sex School Girls is the Same as that of their Single Sex School Counterparts in Science and Technology Subjects

From figure 5.18 above, we observe that 57/59(97%) of the total number of girls from mixed-sex school supported the view that the performance of mixed sex school girls is the same as that of their single sex school counterparts in science and technology subjects while the remaining 2/59(3%) could not agree with the statement. Only 7/81(9%) of female students from single-sex school believed that girls from the two schools' performance is the same while the majority of single sex school female students 74/81(91%) disagreed with the view. It is noted that the mixed sex school has the highest percentage of learners who agree with the statement. We can conclude that girls' performance in science and technology subjects between the two schools is the same. However, a statistical test for significant difference between the two schools' performance is needed because the agreed percentages from the mixed sex school girls and the contrary views from the single sex school are almost equal.

Thus, we need to prove statistically if there is any significant difference in terms of performance in science and technology subjects between girls' perceptions at the single sex school and their counterparts at the mixed sex school.

5.3.1.3 Summary of results on access

- **Parents play an important role in influencing subject choices by learners along gender lines.** This view is confirmed by the majority of single sex school girls 77/81(95%)-4/81(5%), mixed sex school boys 50/53(94%)-3/53(6%) and mixed sex school girls 55/59(93%)-4/59(7%) (Figure 5.1) who reported that their parents give them work to do on the basis of their genders.

- **The family can either promote or limit learners' access to science and technology subjects.** This was validated by a larger number of single sex school girls 69/81(85%)-12/81(15%), mixed sex school boys 47/53(89%)-6/53(11%) and mixed sex school girls 52/59(88%)-7/59(12%) (Figure 5.2) whose view was that they discuss subjects they study at school, including science and technology with their parents.

- **Schools channel subjects on gender lines.** This perception is supported by the majority of female learners 47/59(80%)-12/59(20%) at the mixed sex school and a single sex school 74/81(91%)-7/81(9%) who felt that there were science and technology subjects that they wanted to study but were not offered at their schools (Figure 5.11). The view is also shared by the minority of male learners 16/53(30%)-37/53(70%) at the mixed sex school. It is evident from these findings that girls have been disadvantaged more than boys in terms of access to some of those subjects which have traditionally been regarded as male defined, namely, Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work, Building and Metal Work.

- **Learners have the desire to study science and technology subjects.** This was corroborated by a higher percentage of single sex school female learners 74/81(91%)-7/81(9%), mixed sex school male learners 51/53 (96%)-2/53(4%) and mixed sex school girls 56/59(95%)-3/59(5%) who reported that that they would study science and technology subjects if given an opportunity (Figure 5.10). In view of these findings, one can conclude that if ever there may be under-representation of a particular gender in science and technology subjects, certain factors which need to be explored might have played a role.

5.3.1.4 Summary of findings on performance

- **Parents' ideology that is gender biased results in gender differential performance in science and technology subjects.** This point of view is substantiated by the majority of learners from the three categories being compared namely, single sex school girls, mixed sex school boys and mixed sex school girls. They all supported the view that parents' attitudes and expectations at home can influence boys and girls to perform differently in science and technology subjects at school. Figures to back the standpoint are: 72/81(89%)-9/81(11%), 45/53(85%)-8/53(15%) and 48/59(81%)-11/59(19%) respectively (Figure 5.12). It is evident that parents create an uneven playing field in terms of boys' and girls' performance in science and technology subjects.

- **Socialising agents perpetuate differential performance in science and technology subjects.** This view is confirmed by a larger number of girls at the single sex school 79/81(98%)-2/81(2%) (Figure 5.13). The majority of boys at the mixed sex school 49/53(92%)-4/53(8%) and girls at the same school 52/59(88%)-7/59(12%) also agreed that the family, friends, media and the school environment influence boys and girls to perform differently in science and technology subjects.

- **Boys perform better than girls in science and technology subjects.** This is attested by the higher percentage of mixed sex school girls 56/59(95%)-3/59(5%) who supported the view that boys perform better than girls in science and technology subjects (Figure 5.16). However, single sex school girls 9/81(11%)-72/81(89%) and mixed sex school boys 18/53(34%)-35/53(66%) not feel the same.

- **Performance of mixed sex school girls in science and technology subjects is the same as that of single sex school girls.** A comparison of girls' perceptions from the two schools validated this point of view. A larger number of mixed sex school girls supported this view 57/59(97%)-2/59(3%) compared to their single sex school counterparts 7/81(7%)-74/81(91%) authenticated the view that mixed sex and single sex schools girls' performance in science and technology subjects is at par (Figure 5.18). More respondents at the single sex school did not support the view but the percentage is smaller than that of their mixed sex school counterparts who supported this opinion. In view of the above, it was concluded that mixed sex and single sex school girls' performance in science and technology subjects is at par.

5.4 CHI-SQUARED RESULTS ON AN ACCESS QUESTION BASED ON LEARNERS' PERCEPTIONS

This section presents chi-squared results on an access question that sought learners' perceptions on whether there were science and technology subjects they wanted to study but were not offered by their schools. Specifically, the access statement was structured in the following manner: "There are science and technology subjects that I wanted to study but are not taught at this school". Learners were made aware of the science and technology subjects that were within this study's scope namely: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work, Building and Metal Work.

A test for significant difference in terms of their views on boys' and girls' access to the subjects named above was undertaken comparing girls' perceptions at a single sex and those of their counterparts at a mixed sex school as well as boys and girls learning together at a mixed sex school. A test was also done between boys at the mixed sex school and girls at the single sex school. The key on each graph shows the categories of learners being compared.

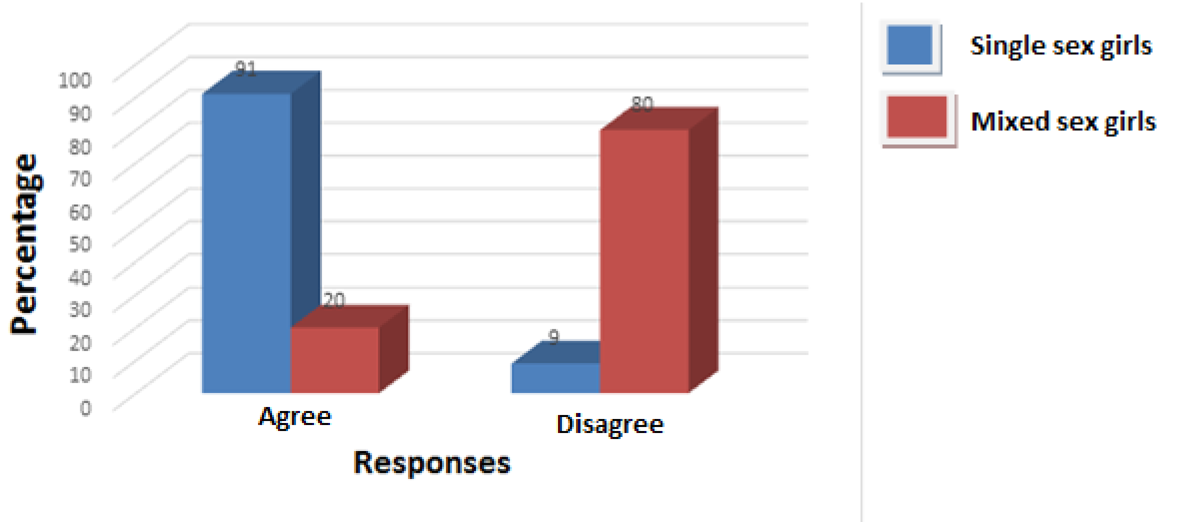

Figure 5.19: There are Science and Technology Subjects that I Wanted to Study but are not Taught at this School

Figure 5.19 shows that, whereas 74/81(91%) of the female learners from the single sex school felt that they had limited access to science and technology subjects, only 12/59(20%) of the female learners from the mixed sex school felt the same. The estimated odds of a learner from a single sex school responding that they have limited access to science and technology subjects are 41 times higher those of a learner from a mixed sex school.

The perception on the availability of desired science and technology subjects is dependent on whether a learner is from a single sex or mixed sex school (p-value=0.00). Learners' perceptions on figure 5.19 show significant difference in access to science and technology subjects which favours female learners from a mixed sex school. Thus, chi-square results with regards to learners' views showed that there was an association in terms of learners' access to the subjects and their type of school with single sex school girls being on the disadvantage. Therefore, the null hypothesis which indicated that there is no significant difference in access to science and technology subjects between single sex school girls and mixed sex school girls was rejected. Although these findings are based on perceptions, limiting single sex school girls' access to certain science and technology subjects is not in line with the Convention on the Rights of the Child (CRC), Article 28, which compels state parties to encourage the development of different forms of education including general and vocational education and make them available and accessible to every child, both girls and boys (Arnot & Pennel, 2008:7; UNESCO, 2012:19).

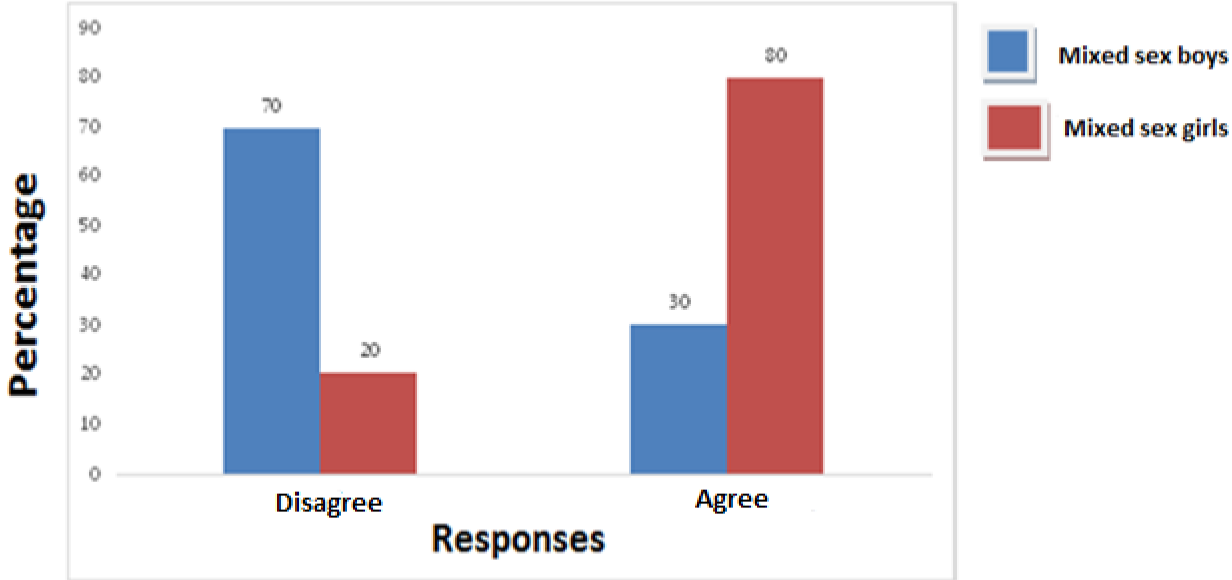

Figure 5.20: There are Science and Technology Subjects that I Wanted to Study but are not Offered at this School

Figure 5.20 presents results on perceptions of the boys and girls at the mixed sex school on the availability of science and technology subjects they wanted to study but were not offered by their school. The test for association between learners' gender and the statement, "There are science and technology subjects that I wanted to study but are not taught at this school" shows that there is a correlation between access responses and gender (chi-squared value = 27.77, df = 1, $p < 0.05$). Thus, the responses obtained from the learners depended on their gender. For instance, it is shown on the graph that most boys 37/53(70%) disagreed while the majority of the girls 47/59(80%) agreed that there were some science and technology subjects they wanted to do but were not offered at the school. Therefore, mixed sex school girls felt that they had limited access to science and technology subjects at school. On the contrary, boys at the same school are of the view that science and technology subjects that they wanted to study are offered at their school. This means that there is significant difference in favour of boys when it comes to boys' and girls' access to science and technology subjects at school.

In view of this, the null hypothesis which claimed no significant difference in access to science and technology subjects by boys and girls at a mixed sex school was therefore, rejected.

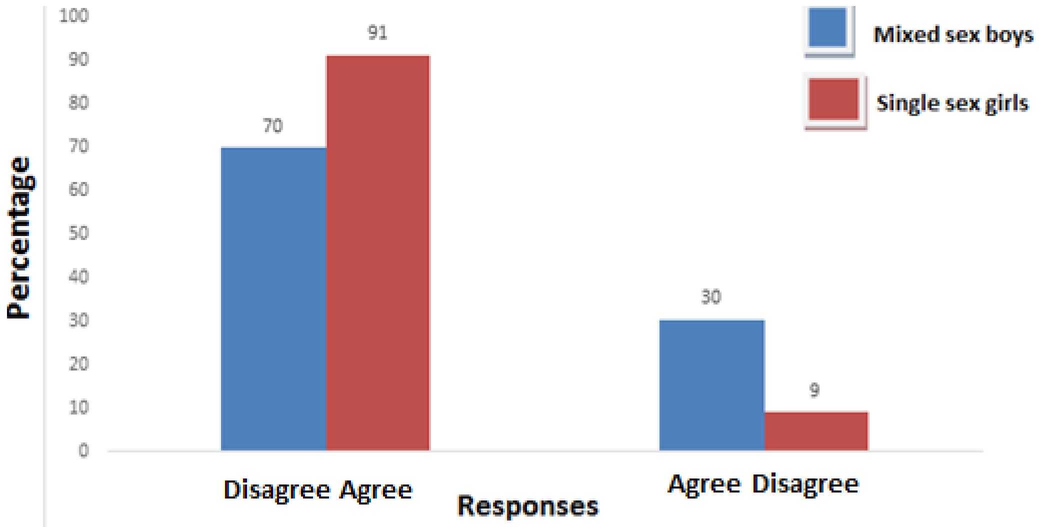

Figure 5.21: There are Science and Technology Subjects that I Wanted to Study but are not Taught at this School

Statistical results show significant difference in favour of single sex girls with regards to perceptions of boys from mixed sex and girls from single-sex school on the availability of science and technology subjects that they wanted to study but were not offered at their schools. The chi-squared results (chi-squared value = 10.46, df = 1, $p < 0.05$) show that learners' access to science and technology subjects was associated with gender and school type. Basing on these results, the null hypothesis which claimed no significant difference in learners from the two schools' access to science and technology subjects was rejected.

5.5 CHI-SQUARED RESULTS ON PERFORMANCE IN SCIENCE AND TECHNOLOGY BY SCHOOL TYPE AND GENDER

This section presents statistical results on the perception of learners with regards to their performance in science and technology subjects. The first statement was structured in the following manner: "The performance of mixed sex school girls is the same as that of their single sex school counterparts in science and technology subjects". Based on this statement, a test for significant difference was undertaken comparing the perceptions of mixed sex and single sex school girls. Another statement was on whether boys are viewed to perform better than girls in science and technology subjects. The performance statement was structured as follows: "Boys perform better than girls in science and technology subjects". With regards to learners' perceptions based on the above statement, a test for significant difference was considered in comparing boys at a mixed sex school and girls in a single sex school. Another comparison of the views of boys and girls learning together at a mixed sex school was also carried out. The categories of learners being compared on each graph are shown by the key.

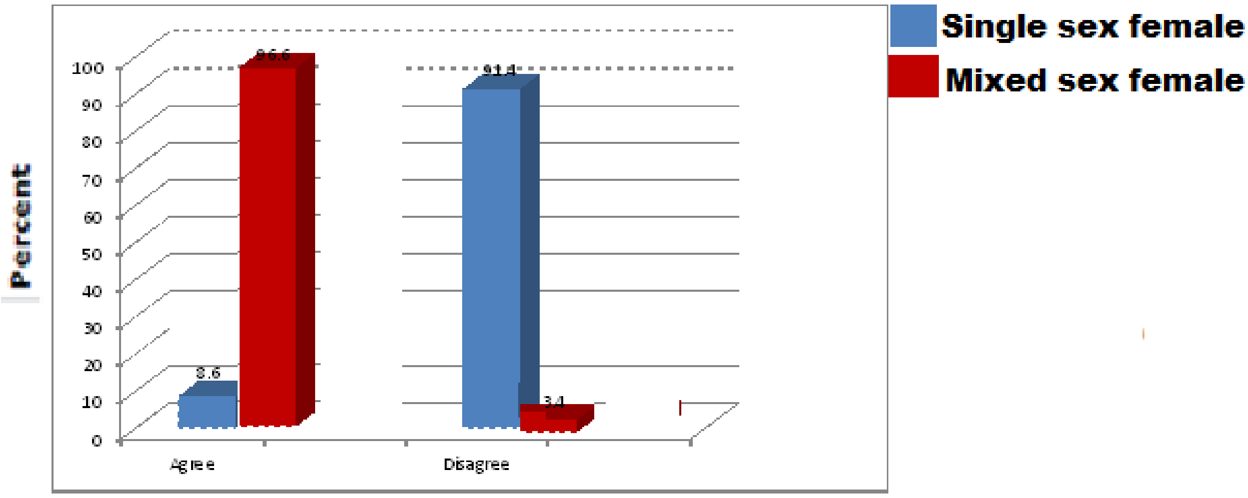

Figure 5.22: Performance of Mixed Sex School Girls is the Same as that of their Single Sex School Counterparts in Science and Technology Subjects

From figure 5.22 above, we observe that 57/59(96.6%) of the total number of girls from mixed-sex school supported the view that the performance of mixed sex school girls is the same as that of their single sex school counterparts in science and technology subjects, while the remaining 2/59(3.4%) did not agree with the statement. Only 7/81(8.6%) of female students from single-sex school believed that girls from the two schools' performance is the same while the majority of single sex school female students 74/81(91.4%) disagreed with the view. A test for association was carried out which showed that the responses of female students were associated with whether one was affiliated to a single-sex school or a mixed-sex school (chi-square = 96.388, df = 1, $p < 0.05$). Therefore, according to learners' perceptions, there is significant difference which favours mixed sex school girls in terms of performance in science and technology subjects. Thus, more learners felt that mixed sex school girls are better than their single sex school counterparts in science and technology subjects. Against this background, the hypothesis which claimed the absence of significant difference in performance between mixed sex and single sex school girls at school was therefore rejected. It is imperative to emphasise that these are perceptions not actual performance. However, they are important in view of the self-fulfilling prophecy (Turner, 2004:343).

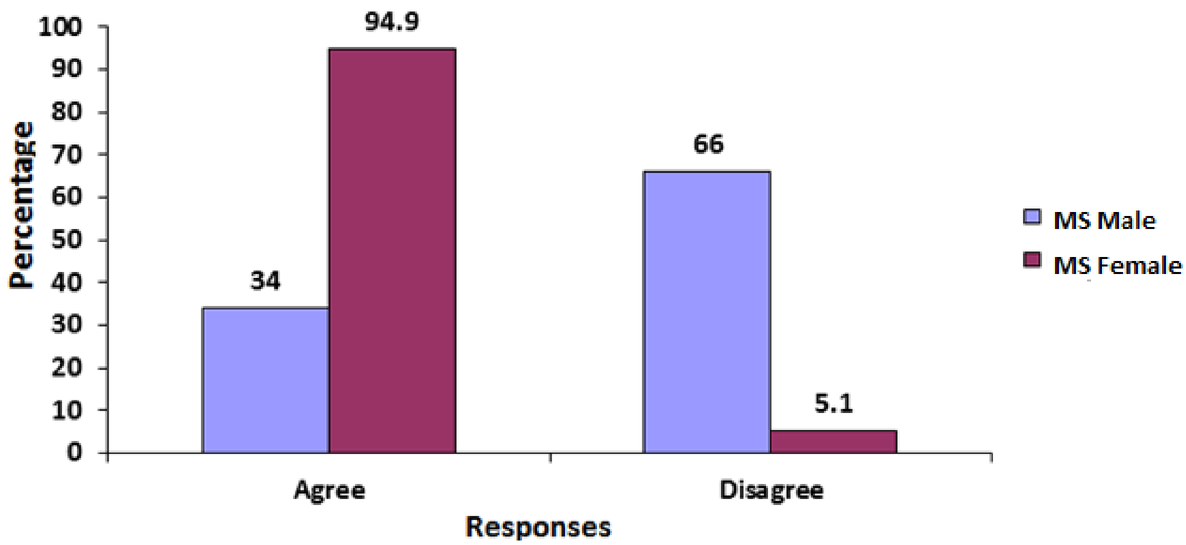

Figure 5.23: Boys Perform Better than Girls in Science and Technology Subjects

Of the total number of male respondents from the mixed sex school, 35/53(66%) agreed with the statement that boys perform better than girls in science and technology subjects while the remaining 18/53(34%) disagreed. Across gender, we observe that 56/59(94.9%) of the total number of girls from mixed sex school supported the view that boys were better than girls in science and technology subjects while the remaining 3/59(5.1%) did not support this view. Chi-squared test were performed to test whether an association could be found between gender and their level of agreement or disagreement to the statement "boys perform better than girls in science and technology subjects". The chi-squared results show that there is an association between participants' responses and their gender (Chi-square = 46.272, df = 1, $p < 0.05$). With regards to learners' perceptions, there is significant difference, with more learners stating that boys perform better than girls in science and technology subjects at school. In other words, there is significant difference in the two groups' responses with boys being perceived to perform better than girls in science and technology subjects at school. Therefore, the hypothesis which claimed no significant difference was rejected. These results show that there is competition in terms of performance in science and technology subjects by gender which is perceived by more girls 56/59(94.9%) than boys 35/53(66%) to give an advantage to boys than girls. Thus, when boys are in the picture, girls' performance in science and technology subjects tends to be overshadowed.

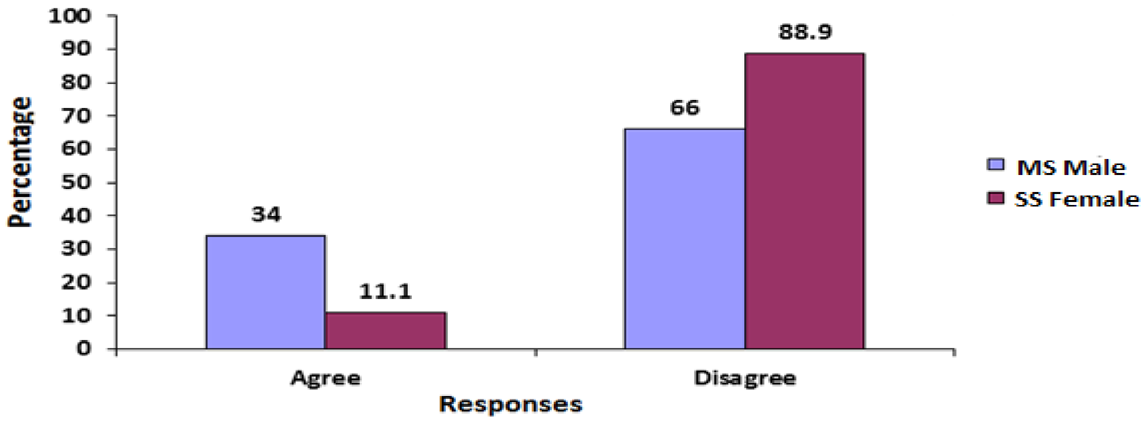

Figure 5.24: Boys Perform Better than Girls in Science and Technology Subjects

With regards to single sex school learners, 88.9% of them believe that boys perform better than girls in science and technology subjects. In the mixed sex school, 34% of the males agreed that boys were better than girls while 66% believed otherwise. A test for association between school type and participants responses revealed that there is association between the two variables (Chi-square = 10.398, df = 1, $p < 0.05$). Thus, there is significant difference with more learners in the two schools believing that girls perform better than boys in science and technology subjects at school. In light of the above, the hypothesis which claimed the absence of the significant difference in performance between the two groups of learners being compared was rejected. This finding is not surprising because there is no gender competition at a single sex school while mixed sex school boys compete with girls.

Therefore, gender competition tends to give an advantage to females learning on their own at a single sex school.

5.5.1 Summary of Statistical Results on Access to Science and Technology

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- Single sex and mixed sex school female learners' perceptions from the questionnaire instrument about their access to science and technology subjects (Figure 5.19) revealed significant difference in favour of mixed sex school female learners (p-value=0.00).

- In terms of access between boys and girls learning together in a mixed sex school, learners' perceptions from the questionnaire instrument (Figure 5.20) established significant difference which favoured boys (chi-squared value = 27.77, df = 1, p< 0.05).

- Statistical results from the questionnaire instrument with regards to mixed sex school boys' and single sex school girls' perceptions on their access to science and technology subjects (Figure 5.21) indicated significant difference which favoured girls (chi-squared value = 10.46, df = 1, p < 0.05).

5.5.2 Summary of Chi-square Results on Performance in Science and Technology

- With regards to performance, mixed sex and single sex school girls' views from the questionnaire instrument about their performance in science and technology subjects depicted significant difference in favour of mixed sex school girls (chi-square = 96.388, df = 1, p < 0.05) (Figure 5.22).

- On performance between boys and girls learning together in a mixed sex school, learners' perceptions from the questionnaire instrument showed significant difference which favoured boys (chi-square = 46.272, df = 1, p < 0.05) (Figure 5.23).

- Chi-square results from the questionnaire instrument with regards to mixed sex school boys' and single sex school girls' views on their performance in science and technology subjects revealed significant difference in favour of girls (chi-square = 10.398, df = 1, $p < 0.05$) (Figure 5.24).

5.6 STATISTICAL RESULTS FROM SCHOOL DOCUMENTS ON LEARNERS' ACCESS AND PERFORMANCE

In this section, statistical results from the ZIMSEC, 2016 – 2017, 'O' and 'A' Level final national examinations from a single sex school and a mixed sex school are presented. It answered the hypothesis pertaining to whether there is any significant difference between girls from a single sex school and those from a mixed sex school in terms of access to and performance in science and technology subjects. It also responded to the hypotheses with regards to the existence of any statistical difference in access to and performance in science and technology subjects between boys and girls learning together in a mixed sex school as well as boys in a mixed sex school and girls in a single sex school. Cross tabulations on Tables 5.1, 5.2 and 5.3 in this section answered the access aspect while those on Tables 5.4, 5.5 and 5.6 answered the performance part.

5.6.1 Access Results from School Documents

In presenting access results from school documents, the access part of the three quantitative objectives of the study is responded to. Cross tabulations are accompanied by a descriptive summary of the quantitative data.

Table 5.1: Access to Science and Technology Subjects for Female Learners at Single and Mixed-sex Schools

Level	Subject	Single Sex	Mixed Sex	Total	p-value
O Level	Mathematics	253	221	474	**0.15**
	Physics	93	40	133	**0.000***
	Chemistry	97	43	140	**0.000***
	Integrated Science	242	220	462	**0.33**
	Agriculture	86	22	108	**0.000***
	Technical Graphics	0	6	6	**0.031***
	Building	0	3	3	**-**
	Wood Work	0	2	2	**-**
A Level	Mathematics	129	46	175	**0.000***
	Physics	68	16	84	**0.000***
	Chemistry	93	23	116	**0.000***
	Agriculture	13	0	13	**0.0002***
Total	Mathematics	382	267	649	**0.000***
	Physics	161	56	217	**0.000***
	Chemistry	190	66	256	**0.000***
	Integrated Science	242	220	462	**0.32**
	Agriculture	99	22	121	**0.000***
	Technical Graphics	0	6	6	**-**
	Building	0	3	3	**-**
	Wood Work	0	2	2	**-**

Table 5.1 above shows significant differences in favour of single sex school girls in three out of five comparable subjects at 'O' Level. These are: Physics (93/40:p-value=0.000), Chemistry (97/43:p-value=0.000) and Agriculture (86/22:p-value=0.000). Results from the same table depict no significant differences in access to science and technology subjects in two 'O' Level subjects. These are: Mathematics (253/221:p-value=0.15) and Integrated Science (242/220:p-

value=0.33). Although the enrolment figures for the two subjects above are not equal, statistical tests give us 95% confidence that they are almost equal and the differences (if any) are insignificant.

At Advanced Level, only Mathematics, Physics and Chemistry were comparable between the two groups under study. Based on these three 'A' Level subjects, I noted that the statistical test results showed the existence of a correlation between access to the subjects and the school type (p-value<10.05). The null hypothesis which claimed no association between access and school type was rejected for 'A' Level Mathematics (129/46:p-value=000), Physics (68/16:p-value=000) and Chemistry (93/23:p-value=000). Overall, access results from Table 5.1 for both 2016 and 2017, 'O' and 'A' Level subjects show that access to science and technology subjects was in favour of girls in a single sex school than their counterparts in a mixed sex school. This finding is expected because there is no gender competition in terms of access at a single sex school while mixed sex school girls compete with boys. This gives an edge to single sex school girls than their mixed sex school counterparts.

It is important to indicate that even if the statistical results found no significant differences in the two 'O' Level subjects above (Mathematics and Integrated Science), enrolment figures for single sex school girls are higher than those of their mixed sex school colleagues in both subjects (Table 5.1). Overall, it is evident that single sex school girls had more students than their mixed sex school counterparts in 'O' Level Physics (93/40), Chemistry (97/43), Mathematics (253/221), Integrated Science (242/220) and Agriculture (86/22). They also had more students in 'A' Level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). Therefore, in terms of numbers, the single sex school girls had higher access to science and technology subjects in all 'O' and 'A' Level subjects. The reason for this is that in a single sex school all learners are girls who compete among themselves for enrolment space while in mixed sex school girls compete with boys. So, the presence of boys in a mixed sex school tends to disadvantage girls in terms of vacancies.

Table 5.2: Cross Tabulations on Access to Science and Technology Subjects for Male and Female Learners in a Mixed Sex School

Level	Subject	Male	Female	Total	p-value
O Level	Mathematics	198	221	419	**0.28**
	Physics	46	40	86	**0.59**
	Chemistry	46	43	89	**0.83**
	Integrated Science	205	220	425	**0.49**
	Agriculture	30	22	52	**0.33**
	Technical Graphics	41	6	47	**0.000***
	Building	19	3	22	**0.000***
	Wood Work	29	2	31	**0.000***
A Level	Mathematics	65	46	111	**0.09**
	Physics	38	16	54	**0.00***
	Chemistry	37	23	60	**0.09**
Total	Mathematics	263	267	530	**0.89**
	Physics	84	56	140	**0.02***
	Chemistry	83	66	149	**0.18**
	Integrated Science	205	220	425	**0.49**
	Agriculture	30	22	52	**0.33**
	Technical Graphics	41	6	47	**0.000***
	Building	19	3	22	**0.000***
	Wood Work	29	2	31	**0.000***

Table 5.2 shows significant differences in access which favour boys in ‘O’ Level Technical Graphics (41/6:p-value=0.000), Building (19/3:p-value=0.000) and Wood Work (29/2:p-value=0.000). It also shows no significant differences in ‘O’ Level Mathematics (198/221:p-value=0.28), Physics (46/40:p-value=0.59), Chemistry (46/43:p-value=0.83), Integrated Science (205/220:p-value=0.49) and Agriculture (30/22:p-value=0.33).

Only Physics (38/16:p-value=0.000) depicted a significant difference in favour of boys at ‘A’ Level while access is the same for ‘A’ Level Mathematics (65/46:p-value=0,09) and Chemistry (37/23:p-value=0,09). In terms of enrolment figures, boys have an upper hand in the majority of ‘O’ Level subjects, namely, Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). Access in terms of numbers in ‘O’ Level Mathematics (198/221) and Integrated Science (205/220) is in favour of girls. Again, boys have higher access in terms of numbers in all comparable ‘A’ Level subjects, namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23). Overall, the significant difference in terms of access is in favour of boys.

In view of this, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected. The competition for space by gender which evident in the mixed sex school tends to result in girls being subdued by boys with regards to access in science and technology subjects.

Table 5.3: Chi-square Test Results on Access to Science and Technology Subjects for Boys in a Mixed Sex School and Girls in a Single Sex School

Level	Subject	Male	Female	Total	p-value
O Level	Mathematics	198	253	451	**0.01***
	Physics	46	93	139	**0.000***
	Chemistry	46	97	143	**0.000***
	Integrated Science	205	242	447	**0.09**
	Agriculture	30	86	116	**0.000***
	Technical Graphics	41	0	41	**0.000***
	Building	19	0	19	**0.000***
	Wood Work	29	0	29	**0.000***
A Level	Mathematics	65	129	194	**0.000***
	Physics	38	68	106	**0.004***
	Chemistry	37	93	130	**0.000***
	Agriculture	0	13	13	**0.000***
Total	Mathematics	263	382	645	**0.000***
	Physics	84	161	245	**0.000***
	Chemistry	83	190	273	**0.000***
	Integrated Science	205	242	447	**0.08**
	Agriculture	30	99	129	**0.000***
	Technical Graphics	41	0	41	**0.000***
	Building	19	0	19	**0.000***
	Wood Work	29	0	29	**0.000***

Table 5.3 above shows that access to science and technology subjects was in favour of girls in a single sex school except in ‘O’ Level Integrated Science (205/242:p-value=0.09) where access was equal. At ‘O’ Level, access was in favour of single-sex female learners in 4 out of 5 comparable subjects. These were: Mathematics (198/253:p-value=0.01), Physics (46/93:p-value=0.000), Chemistry (46/97:p-value=0.000) and Agriculture (30/86:p-value=0.000).

At ‘A’ Level, access was in favour of single-sex girls in all three comparable subjects. These were: Mathematics (65/129:p-value=0.000), Physics (38/68:p-value=0.004), Chemistry (37/93:p-value=0.000). In terms of numbers, single sex school girls have higher access to science and technology subjects in all comparable ‘O’ and ‘A’ Level subjects above. These are ‘O’ Level integrated science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as ‘A’ Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93). All in all, the significant difference in terms of access was in favour of single sex school girls. Therefore, the hypothesis which claimed the absence of significant difference in access between mixed sex school boys and single sex school female learners at school was rejected. The reason for this finding is that single sex school girls compete for access on their own while mixed sex school boys compete with girls. Generally, this tends to give a clear advantage to girls learning on their own.

5.6.2 Access to Subjects which the Two Schools Offer

It is evident from Tables 5.1-5.3 above that both schools offer Mathematics, Physics, Integrated Science and Chemistry as science subjects which are within this study’s scope. The difference is on the technology subjects which the two schools offer. The only technology related subject offered in a single sex school was agriculture while a mixed sex school offered Wood Work, Building and Technical Graphics, in addition to Agriculture. Thus, out of nine science and technology related subjects which fall within this study’s scope, the single sex school offered five while the mixed sex school offered eight. It implies that the single sex school was denying the girl child an opportunity to access or study four technology related subjects namely: Metal Work, Wood Work, Building and Technical Graphics. On the other hand, the mixed sex school was denying both boys and girls of an opportunity to access metalwork. In light of the above, it can be concluded that, schools’ categorisation and distribution of knowledge along gender lines resulted in single sex school girls failing to study four technology subjects while mixed sex school boys and girls were disadvantaged in one subject.

Comparatively, a single sex school was worse in terms of girls’ access to science and technology subjects than a mixed sex school because it offered five subjects out of nine compared to eight taught at a mixed sex school (Tables 5.1-5.3). By inference, the presence of more technology related subjects in a mixed sex school was meant to cater for boys since the subjects were traditionally regarded as male inclined and more were offered to boys than girls. With these results, the school setting can, to a certain extent be regarded as gender insensitive because it denies girls, especially those at a single sex school, and to a lesser extent, those from a mixed sex school of opportunities to pursue the above-named technology subjects. Denying learners of opportunities to study certain technology related subjects at school is against Article 26, of the Universal Declaration of Human Rights (UDHR) (1948) which underscores the need for governments to offer gender-sensitive curricula and gender-response education in terms of equal access to, and performance in primary and secondary education as well as all subjects offered in those levels (Stromquist, 2001:47; UNESCO, 2012b:58).

5.6.3 Performance Results from School Documents

This section presents statistical results on learners' actual performance from school documents. It answers the performance aspect of the three quantitative objectives of the study.

Table 5.4: Performance in Science and Technology Subjects for Girls in the Single Sex and Mixed Sex School

Subjects	Level	School	Outcome Pass	Fail	Access to Science and Technology Subjects	Chi-square	Degree of Freedom	P-value
Mathematics	O Level	Single Sex	200 (79%)	53 (21%)	253 (53%)	56.607	1	**0.000***
		Mixed Sex	101 (46%)	120 (54%)	221 (47%)			
	A Level	Single Sex	125 (97%)	4 (3%)	129 (74%)	6.222	1	**0.013*,b**
		Mixed Sex	40 (87%)	6 (13%)	46 (26%)			
Physics	O Level	Single Sex	90 (97%)	3 (3%)	93 (70%)	36.709	1	**0.000***
		Mixed Sex	22 (55%)	18 (45%)	40 (30%)			
	A Level	Single Sex	67 (99%)	1 (1%)	68 (81%)	.238	1	.626b,c
		Mixed Sex	16 (100%)	0 (0%)	16 (19%)			
Chemistry	O Level	Single Sex	92 (95%)	5 (5%)	97 (69%)	6.398	1	**0.011*,b**
		Mixed Sex	35 (81%)	8 (19%)	43 (31%)			
	A Level	Single Sex	91 (98%)	2 (2%)	93 (80%)	.353	1	.552b,c
		Mixed Sex	22 (96%)	1 (4%)	23 (20%)			
Integrated Science	O Level	Single Sex	221 (91%)	21 (9%)	242 (52%)	46.487	1	**0.000***
		Mixed Sex	144 (65%)	76 (35%)	220 (48%)			
Agriculture	O Level	Single Sex	84 (98%)	2 (2%)	86 (80%)	8.394	1	**0.004*,b**
		Mixed Sex	18 (82%)	4 (18%)	22 (20%)			

- The Chi-square statistic is significant at the 0.05 level.
- More than 20% of cells in this sub-table have expected cell counts less than 5. Chi-square results may be invalid.

- The minimum expected cell count in this sub-table is less than one. Chi-square results may be invalid.

Chi-squared results above summarise the level of association in terms of performance in science and technology subjects between female learners from a single-sex school and female learners from a mixed-sex school. Results for the 2016 and 2017 were combined to make analysis easy. The differences in pass rates between the two schools are statistically significant in all 5 'O' Level comparable subjects with single sex girls performing better than their mixed sex counterparts. Single sex female learners performed better in Mathematics (200/253[79%]-101/221[46%]:p.v=0.000), Physics (90/93[97%]-22/40[55%]:p.v=0.000), Chemistry (92/97[95%]-35/43[81%]:p.v=0.011), Integrated Science (221/242[91%]-144/220[65%]:p.v=0.000) and Agriculture (84/86[98%]-18/22[82%]:p.v=0.004).
At 'A' Level, the performance of learners from the two different schools is associated with the school entry type for Mathematics only where the p-value is less than 0.05. This implies that there is significant difference that favours single sex school girls in terms of performance in the subject (125/129[97%]-40/46[87%]:p.v=0.013).

Statistical results show no significant difference in 'A' Level Physics (67/68[99%]-16/16[100%]:p.v=0.26) and Chemistry (91/93[98%]-22/23[96%]:p.v=0.552).

It is interesting to note that in all subjects including 'A' Level Physics and Chemistry which show no significant difference in performance between the two schools, the single sex school girls have higher percentage pass rates except in 'A' Level Physics where mixed sex school girls are on top (Table 5.4). Thus, it can be concluded that there are statistically significant differences between the performance of girls in a single-sex school and those in a mixed-sex school, with single sex school girls having higher performance than their counterparts from a mixed-sex school. From the above findings, the hypothesis which claimed no significant difference in terms of performance between the two categories of learners being compared was rejected. Gender competition which is evident in the mixed sex school tends to be the reason for this finding. Lack of competition with boys tends to give single sex school girls an upper hand with regards to performance in science and technology subjects over their mixed sex school counterparts.

Table 5.5: Chi-Square Test Results on Performance Outcomes of Boys and Girls in a Mixed-Sex School

			Performance		Access to			
Subject	**Level**	**Gender**	**Pass**	**Fail**	**S & T Subjects**	**Chi-square**	**Degree of Freedom**	**P-value**
Mathematics	O Level	Male	117 (59%)	81 (41%)	198 (47%)	7.502	1	**$.006^{*}$**
		Female	101 (46%)	120 (54%)	221 (53%)			
	A Level	Male	59 (91%)	6 (9%)	65 (59%)	.406	1	$.524^{b}$
		Female	40 (87%)	6 (13%)	46 (41%)			
Physics	O Level	Male	36 (78%)	10 (22%)	46 (53%)	5.272	1	**$.022^{*}$**
		Female	22 (55%)	18 (45%)	40 (47%)			
	A Level	Male	32 (84%)	6 (16%)	38 (70%)	2.842	1	$.092^{b}$
		Female	16 (100%)	0 (0%)	16 (30%)			
Chemistry	O Level	Male	43 (93%)	3 (7%)	46 (52%)	2.996	1	.083
		Female	35 (81%)	8 (19%)	43 (48%)			
	A Level	Male	32 (86%)	5 (14%)	37 (62%)	1.324	1	$.250^{b}$
		Female	22 (96%)	1 (4%)	23 (38%)			
Integrated Science	O Level	Male	148 (72%)	57 (28%)	205 (48%)	2.242	1	.134
		Female	144 (65%)	76 (35%)	220 (52%)			
Agriculture	O Level	Male	22 (73%)	8 (27%)	30 (58%)	.515	1	.473
		Female	18 (82%)	4 (18%)	22 (42%)			
Technical Graphics	O Level	Male	35 (85%)	6 (15%)	41 (87%)	1.296	1	$.255^{b}$
		Female	4 (67%)	2 (33%)	6 (13%)			
Building	O Level	Male	8 (42%)	11 (58%)	19 (86%)	1.985	1	$.159^{b}$
		Female	0 (0%)	3 (100%)	3 (14%)			
Wood Work	O Level	Male	24 (83%)	5 (17%)	29 (94%)	1.286	1	$.257^{b,c}$
		Female	1 (50%)	1 (50%)	2 (6%)			

- The Chi-square statistic is significant at the .05 level.
- More than 20% of cells in this sub-table have expected cell counts less than 5. Chi-square results may be invalid.

- The minimum expected cell count in this sub-table is less than one. Chi-square results may be invalid.

The table 5.5 above shows significant differences in performance, with boys performing better in only 2 ‘O’ Level subjects. These were Mathematics (117/198[59%]-101/221[46%]:p.v=0.006) and Physics (36/46[78%]-22/40[55%]:p.v=0.022). The rest, which consisted of 6 ‘O’ and 3 ‘A’ Level subjects did not show any significant differences in performance between males and females learning together at a mixed sex school. Ordinary Level subjects which did not show any significant differences in boys’ and girls’ performance were Chemistry (43/46[93%]-35/43[81%]:p.v=0.083), Integrated Science (148/205[72%]-144/220[65%]:p.v=0.134), Agriculture (22/30[73%]18/22[82%]:p.v=0.473), Technical Graphics (35/41[85%]-4/6[67%]:p.v=0.255), Building (8/19[42%]-0/3[0%]:p.v=0.159) and Wood Work (24/29[83%]-1/2[50%]:p.v=0.257).

Advanced level subjects which did not show any significant differences in boys’ and girls’ performance were Mathematics (59/65[91%]-40/46[87%]:p.v=0.524), Physics (32/38[84%]-16/16[100%]:p.v=0.092) and Chemistry (32/37[86%-22/23[96%]:p.v=0.250). If we check raw scores (percentages), boys seemed to have an upper hand, but chi-square results failed to reject the null hypothesis. Overall, boys’ and girls’ performance in the mixed sex school was the same. This means that gender did not play a role in determining whether a learner passed or failed science and technology subjects at a mixed sex school. Therefore, the chi-square results did not reject the null hypothesis which claimed no significant difference in performance between mixed sex school boys and girls. In other words, there is no gender difference in performance of study participants in Mathematics, Physics and Chemistry, although boys generally had an upper hand. The reason for this finding may be increased efforts in gender equity issues in education as advocated by the 2004 national Gender Policy and the 2008 SADC Protocol on Gender and Development among others (Gudhlanga, Chirimuuta & Bhukuvhani, 2012:35). In light of the advocacy, one can conclude that gender parity in performance seems to be emerging now.

Table 5.6: Statistical Outcomes on Performance of Girls in a Single-sex School and Boys in a Mixed-sex School in Science and Technology Subjects

Subject	Level	School	Outcome Pass	Fail	Access to S& T subjects	Chi-square	Df	p-value
Mathematics	O Level	Single Sex	200 (79%)	53 (21%)	253 (53%)	56.607	1	**.000***
		Mixed Sex	101 (46%)	120 (54%)	221 (47%)			
	A Level	Single Sex	125 (97%)	4 (3%)	129 (74%)	6.222	1	**.013*,b**
		Mixed Sex	40 (87%)	6 (13%)	46 (26%)			
Physics	O Level	Single Sex	90 (97%)	3 (3%)	93 (70%)	36.709	1	**.000***
		Mixed Sex	22 (55%)	18 (45%)	40 (30%)			
	A Level	Single Sex	67 (99%)	1 (1%)	68 (81%)	.238	1	.626[b,c]
		Mixed Sex	16 (100%)	0 (0%)	16 (19%)			
Chemistry	O Level	Single Sex	92 (95%)	5 (5%)	97 (69%)	6.398	1	**.011[*,b]**
		Mixed Sex	35 (81%)	8 (19%)	43 (31%)			
	A Level	Single Sex	91 (98%)	2 (2%)	93 (80%)	.353	1	.552[b,c]
		Mixed Sex	22 (96%)	1 (4%)	23 (20%)			
Integrated Science	O Level	Single Sex	221 (91%)	21 (9%)	242 (52%)	46.487	1	**.000***
		Mixed Sex	144 (65%)	76 (35%)	220 (48%)			
Agriculture	O Level	Single Sex	84 (98%)	2 (2%)	86 (80%)	8.394	1	**.004[*,b]**
		Mixed Sex	18 (82%)	4 (18%)	22 (20%)			
	A Level	Single Sex	12 (92%)	1 (8%)	13 (12%)			
		Mixed Sex	0	0	0 (0%)			
Technical Graphics	O Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	4 (67%)	2 (33%)	6 (6%)			
	A Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	0	0	0 (0%)			
Building	O Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	0 (0%)	3 (100%)	3 (3%)			
	A Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	0	0	0 (0%)			
Wood Work	O Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	1 (50%)	1 (50%)	2 (2%)			
	A Level	Single Sex	0	0	0 (0%)			
		Mixed Sex	0	0	0 (0%)			

Results are based on nonempty rows and columns in each innermost sub-table.

- The Chi-square statistic is significant at the .05 level.

- More than 20% of cells in this sub-table have expected cell counts less than 5. Chi-square results may be invalid.

Figure 5.24 shows 5 comparable ordinary level subjects between single-sex school girls and mixed-sex school boys. These were: Mathematics, Physics, Chemistry, Integrated Science and Agriculture. Statistically, learners' performance on the above-named subjects was: Mathematics (200/253[79%]-101/221[46%]:p.v=0.000), Physics (90/93[97%]-22/40[55%]:p.v=0.000), Chemistry (92/97[95%]-35/43[81%]:p.v=0.011), Integrated Science (221/242[91%]-144/220[65%]:p.v=0.000) and Agriculture (84/86[98%]-18/22[82%]:p.v=0.004). The results above show that performances differed statistically between girls in the single-sex school and boys in the mixed sex school for science and technology subjects. Figures depict significant differences in pass rates in favour of girls in a single sex school in all 5 'O' Level subjects which were comparable.

At 'A' Level, learners' performance in three comparable subjects was as follows: Mathematics (125/129[97%]-40/46[87%]:p.v=0.013), Physics (67/68[99%]-16/16[100%]:p.v=0.626) and Chemistry (91/93[98%]-22/23[96%]:p.v=0.552). Results on the three 'A' Level subjects, show no significant differences in performance between the two groups of learners in Physics and Chemistry. Mathematics is the only 'A' Level subject among the three comparable ones that depict significant difference with single sex school girls performing better than mixed sex school boys.

Basing on the chi-squared results in Table 5.6, it is evident that there is an association between performance and school entry type in all the 5 comparable 'O' Level subjects namely: Mathematics, Physics, Chemistry, Integrated Science and Agriculture. There is also an association between performance and school entry type in 'A' Level Mathematics. 'A' Level Physics and Chemistry were the only 2 subjects where performance was the same. This means that the possibility of a learner passing or failing in science and technology subjects was associated with whether a learner was a girl from a single-sex school or a boy from a mixed sex school.

Even by looking at the percentage pass rates without considering chi-square tabulations, results depict that single sex school girls had an upper hand in all 'O'

Level subjects. These were: Mathematics (79%-46%), Physics (97%-55%), Chemistry (95%-81%), Integrated Science (91%-65%) and Agriculture (98%-82%). Single sex female learners also had an upper hand in ‘A’ Level Mathematics (97%-87%) and Chemistry (98%-96%). ‘A’ Level Physics (99%-100%) was the only subject which mixed sex school boys performed better in terms of percentage pass rate as compared to single sex school girls. Overall, there is significant difference in performance in favour of single sex school female learners. Therefore, the null hypothesis which claimed no significant difference in performance in science and technology subjects between girls in a single sex school and boys in a mixed sex school is rejected.

5.6.4 Overall Statistical Results from School Documents on Actual Access of Study Participants

- Statistical tests established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). The hypothesis which claimed the absence of significant difference in terms of access between the two categories of learners being compared was rejected. With regards to numbers, single sex school girls have higher access to science and technology subjects in all comparable ‘O’ and ‘A’ Level subjects compared to mixed sex school girls (Table 5.1). These are: O’ level Physics (93/40), Chemistry (97/43), Mathematics (253/221), Integrated Science (242/220) and Agriculture (86/22) as well as ‘A’ Level mathematics (129/46), Physics (68/16) and Chemistry (93/23). On subjects offered (Table 5.1), mixed sex school girls had more subjects taught at their school and therefore, had more access. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building as compared to Mathematics, Physics, Chemistry, Integrated Science and Agriculture taught at a single sex school.

- With regards to boys and girls learning together at a mixed sex school, statistical findings depicted significant difference ($p<0.05$) in favour of boys

(Table 5.2). Statistical results rejected the null hypothesis which claimed no significant difference in performance between mixed sex and single sex school girls.

In terms of numbers, enrolment figures for boys are superior in ‘O’ Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22) except in Mathematics (198/221) and Integrated Science (205/220) where access is in favour of girls. Again, boys have higher access in terms of numbers in all comparable ‘A’ Level subjects namely: Physics (38/16), Mathematics (65/46) and Chemistry (37/23) (Table 5.2).

Overall, mixed sex school boys have superior access to science and technology subjects compared to girls. On subjects offered (Table 5.2), both mixed sex school boys and girls had access to all subjects which formed the scope of this study, except building. These are: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building.

- Statistical results on access to science and technology subjects between girls at a single sex school and boys at a mixed sex school indicated significant difference ($p<0.05$) in favour of single sex school girls (Table 5.3). The hypothesis which claimed the absence of significant difference in access between mixed sex school boys and single sex school female learners at school was rejected. With regards to numbers, single sex school girls have higher access to science and technology subjects in all comparable ‘O’ and ‘A’ Level subjects that form the scope of this study. These are ‘O’ Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as ‘A’ Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93) (Table 5.3). In terms of subjects offered (Table 5.3), mixed sex school boys had more access as they are exposed to more science and technology related subjects than girls at a single sex school. The mixed sex school taught Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical

Graphics, Wood Work and Building while the single sex school offered Mathematics, Physics, Chemistry, Integrated Science and Agriculture.

5.6.5 Actual Performance from School Documents: Summary of Statistical Results

- With regards to performance between mixed sex school girls and those at a single sex school, statistical findings depicted significant difference ($p<0.05$) in favour of single sex school girls (Table 5.4). Chi-square results rejected the null hypothesis which claimed no significant difference in performance between mixed sex and single sex school girls.

- Statistical findings on performance indicated no significant difference ($p>0.05$) between boys and girls learning together at the same school (Table 5.5). Chi-square results did not reject the null hypothesis which claimed no significant difference in performance between mixed sex school boys and girls.

- Chi-square results revealed significant difference ($p<0.05$) which favoured single sex school girls than mixed sex school boys (Table 5.6). The hypothesis which claimed the absence of significant difference in performance between mixed sex school boys and single sex school female learners at school was rejected.

5.7 SUMMARY OF OBSERVATIONS FROM QUANTITATIVE DATA

This section summarises quantitative findings gathered through questionnaire schedules and school documents namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results. First to be summarised are quantitative results from school documents which provided actual access and performance results of study participants. These findings are then merged and compared with learners’ perceptions on the influence of parents, the school, media and peers on boys’ and girls’ access and performance in science and technology subjects. Some learners’ perceptions were chi-squared while others were not subjected to statistical tests.

It is important to point out that, out of the three data sets, findings from school documents formed the basis of this study's quantitative findings because they gave me real figures on access and performance of learners in science and technology subjects while primary data from questionnaires was mainly on learners' perceptions. Therefore, where results differed I considered findings from secondary data, that is, the 2016 – 2017, 'O' and 'A' Level final national examinations results more than those from primary data, namely, questionnaires. Consequently, I was able to get objective results about boys' and girls' access to and their performance in science and technology subjects at school (Antwi & Hamza, 2015:219). I was also able to derive absolute findings impartially with regards to learners' access to and their performance in the subjects (Livesey, 2011:1).

Quantitative findings on access and performance from the three data sets compared girls in a single sex school and their counterparts in a mixed sex school. Again, a comparison of boys and girls learning together at a mixed sex school as well as boys in a mixed sex school and girls in a single sex school was undertaken.

5.7.1 Quantitative Objective 1: To Establish if there is any Significant Difference in Access to and Performance of Girls in Science and Technology Subjects at Single Sex and Mixed Sex Schools

In terms of this objective, quantitative findings on access and performance compared girls in a single sex school and their counterparts in a mixed sex school. The comparison yielded findings summarised below.

5.7.1.1 Access to science and technology subjects between single sex and mixed sex school girls

Quantitative findings from school documents, namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, revealed that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). The null hypothesis, which claimed that there is no significant difference in terms of single sex and mixed sex school girls' access to science and technology subjects at school was therefore rejected.

Even in terms of numbers, the single sex school girls have higher access to science and technology subjects in all 'O' and 'A' Level subjects (Table 5.1). This is evidenced by the following enrolment figures: 'O' Level Physics (93/40), chemistry (97/43), agriculture (86/22), mathematics (253/221) and integrated science (242/220) as well as 'A' Level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). There is gender competition for access in a mixed sex school and this tends to give an advantage to single sex school girls compared to their counterparts at a mixed sex school.

On subjects offered (Table 5.1), it was established that mixed sex school girls had more subjects taught at their school and therefore, had more access. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building compared to Mathematics, Physics, Chemistry, Integrated Science and Agriculture offered at a single sex school. This observation is supported by more single sex school girls 74/81(91%)-7/81(9%) than their mixed sex school counterparts 47/59(80%)-12/59(20%) who reported that there were science and technology subjects they wanted to study but were not taught at their school. In light of these findings, schools can, to a certain extent, be viewed as channelling subjects on gender lines because they do not avail some of the science and technology subjects which were traditionally regarded as male inclined and offered more to boys than girls. Channelling subjects on gender lines is against Article 10 of CEDAW (1979) which compels state parties to take appropriate measures to eliminate all forms of discrimination against women in the field of education and create a level playing ground for men and women in terms of access to, and performance in all subject areas, including science and technology (Debusscher, 2015:9; UNESCO, 2012b:19, UN, 2014:2).

5.7.1.2 Performance results in science and technology subjects for mixed sex and single sex school girls

With regards to performance, statistical findings from school documents, namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results, (Table 5.4) depicted significant difference ($p<0.05$) in favour of single sex school female learners. The null hypothesis which claimed that there was no significant difference in terms of single sex and mixed sex school girls’ performance in science and technology subjects at school was therefore rejected. Due to gender competition, mixed sex school girls tend to be overshadowed by boys in terms of performance in science and technology subjects. This gives an advantage to single sex school girls who compete among themselves to perform better than mixed sex school girls in the subjects.

5.7.2 Quantitative Objective 2: To Find out if there is any Significant Difference in Access to and Performance in Science and Technology Subjects for Boys and Girls in Mixed Sex Schools

This objective compared access and performance in science and technology subjects for boys and girls in mixed sex schools. A summary of the results is presented below:

5.7.2.1 Access to science and technology subjects between boys and girls learning together at a mixed sex school

With regards to boys and girls learning together at a mixed sex school, statistical findings on access to science and technology subjects from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results depicted significant difference ($p<0.05$) in favour of boys (Table 5.2). Similar findings emerged from mixed sex school boys’ and girls’ perceptions from the questionnaire instrument (Figure 5.20) whose statistical results (chi-squared value = 27.77, df = 1, $p< 0.05$) revealed significant difference in favour of boys.

Overall, the significant difference in terms of access is in favour of boys. In view of this, the hypothesis, which claimed no significant difference in access between boys and girls at this school was rejected.

In terms of enrolment figures (Table 5.2), boys were more than girls in 'O' Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in mathematics (198/221) and integrated science (205/220) subjects only. In all comparable 'A' Level subjects, namely, physics (38/16), mathematics (65/46) and chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects compared to girls. An observation to consider with regards to these findings is the gender competition for access at the mixed sex school which tends to disadvantage girls compared to boys.

On subjects offered (Table 5.2), the study revealed that both mixed sex school boys and girls had access to all subjects which formed the scope of this study, except metal work. These are: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building.

5.7.2.2 Performance findings in science and technology subjects for mixed sex school boys and girls

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results on performance (Table 5.5) between boys and girls learning together in a mixed sex school, revealed no significant difference ($p>0.05$). Chi-square results did not reject the null hypothesis which claimed no significant difference in performance between mixed sex school boys and girls.

This finding may be a result of increased efforts by the AU Conference of African Women in Science and Technology 2007 which called upon governments to support the full participation of girls and women in science and technology related fields (SARDC, 2016:39).

5.7.3 Quantitative Objective 3: To Establish if there is any Significant Difference in Access to and Performance in Science and Technology Subjects Between Boys in a Mixed Sex and Girls in a Single Sex School

With regards to this objective, quantitative findings on access and performance compared girls in a single sex school and boys in a mixed sex school. The comparison yielded findings that are summarised below.

5.7.3.1 Access results for mixed sex school boys and girls learning together in a single sex school

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys (Table 5.3). Similarly, statistical tests (chi-squared value = 10.46, df = 1, $p < 0.05$) from mixed sex school boys' and single sex school girls' perceptions based on the questionnaire instrument (Figure 5.21) revealed significant difference which was in favour of girls. Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: 'O' Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93).

In terms of subjects offered, (Table 5.3), it emerged that mixed sex school boys had more access as they are exposed to more science and technology related subjects than girls at a single sex school. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building while the single sex school offered Mathematics, Physics, Chemistry, Integrated Science and Agriculture. This finding is corroborated by the perceptions of the majority of single sex school girls 74/81(91%)-7/81(9%) compared to mixed sex school boys 16/53(30%)-37/53(70%) who felt that there were science and technology subjects that they would have wanted to study but were not offered at their school. In view of these findings, the school setting can to a certain extent, be regarded as lacking gender neutrality because it promotes gender differential access to science and technology subjects which were traditionally regarded as male defined and offered more to boys than girls. Promoting access to science and technology subjects along gender lines is against the Convention on the Elimination of Discrimination in Education (CEDE) (1960) which commits state parties to formulate, develop and apply a national policy which will promote equality of opportunities and treatment in the matter of education without discrimination based on sex, age, ethnicity, language, location and income level (UNESCO, 2012b:19).

5.7.3.2 Performance in science and technology subjects between mixed sex school boys and single sex school girls

Performance results from single sex school girls and mixed sex school boys using school documents, namely: ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results depicted significant difference that favoured single sex school girls (Table 5.6). In the same vein, statistical results from learners' perceptions based on the questionnaire instrument (chi-square = 10.398, df = 1, $p < 0.05$) showed significant difference in favour of single sex school girls.

In light of these findings from the two data sets, it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls' and mixed sex school boys' performance in science and technology subjects at school is thus, rejected. The reason for this finding may be competition by gender that boys at the mixed sex school are exposed to. Consequently, single sex school female learners who compete among themselves tend to have an advantage over mixed sex school boys in terms of performance in science and technology subjects.

5.8 QUALITATIVE DATA ANALYSIS

The qualitative objective of this study was to explore factors that influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school. In this section, the presentation, analysis and interpretation employed qualitative approaches as outlined in the previous chapter. The data emerged from interviews conducted with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers. These respondents' views with regards to how society, through gender socialisation affects the education of boys and girls in science and technology subjects were extracted. The analysis process was also guided by the theoretical framework, research objectives, research questions and literature review. The respondents were coded as follows: The Head of the mixed sex school as HM and HS for the single sex school. The Deputy Heads for the mixed sex school were coded as DHM and DHS for the single sex school. Heads of Department for the mixed sex school were coded as HODM and numbered according to the order in which they were interviewed while those from the single sex school were coded HODS and numbered in the order in which they were interviewed.

Class teachers for mixed the sex school were coded as CTM and numbered according to the order in which they were interviewed while those from the single sex school were coded CTS and numbered in the order in which they were interviewed. Science and technology subject teachers for the mixed sex school were coded as SM and numbered according to the order in which they were interviewed while those from the single sex school were coded SS and numbered in the order in which they were interviewed. The analysis was carried out as informed by the themes which emerged from the collected data and guided by the research questions (see Table 5.7).

5.9 QUALITATIVE ANALYSIS OF CONTEXTUAL QUESTIONS

Three major themes that emerged from the gathered data were further sub-divided into categories or sub-themes in order to present and analyse participants' views.

The themes which revolved around access and performance responses were presented and analysed in accordance with the delineated, but interrelated sub-themes.

Table 5.7: Themes and Sub-Themes of the Qualitative Study

Themes	Sub-themes
5.9.1 Factors influencing access to science and technology along gender lines	5.9.1.1 Teachers views on influence of the home environment on gender inequality in science and technology education 5.9.1.2 Teachers' views and expectations on the curriculum 5.9.1.3 Gender socialising agents in science and technology 5.9.1.4 Influence of job opportunities on engendering science and technology
5.9.2 Factors influencing school performance in science and technology along gender lines.	5.9.2.1 Family Support on Gender Differentiation in Science and Technology 5.9.2.2 Teachers' classification of knowledge on gender lines 5.9.2.3 Social construction of school performance 5.9.2.4 Influence of job market on engendering science and technology
5.9.3 The school as a gender socialising agent of masculinity and femininity through science and technology.	5.9.3.1 Subject channelling on gender lines 5.9.3.2 The school as an agent for gender equality in science and technology 5.9.3.3 School differential career counselling and treatment of boys and girls 5.9.3.4 School differentiated responsibilities for boys and girls 5.9.3.5 School 'gender typification' of performance in science and technology at schools.

5.9.1 Theme 1: Factors Influencing Access to Science and Technology along Gender Lines

This theme sought to explore factors influencing access to science and technology subjects along gender lines. It intended to assess respondents' awareness and views on factors that could influence boys' and girls' access to science and technology subjects at school. Their knowledge of the role of society in promoting gender inequalities in terms of boys' and girls' access to science and technology subjects was paramount to this study.

5.9.1.1 Teachers views on influence of the home environment on gender inequality in science and technology education

The results of the interview held with mixed sex and single sex school respondents revealed that owing to the influence of the gender ideology inculcated at home at an early age, children tend to identify masculine and feminine roles in relation to the division of labour they are exposed to by their parents. Children are taught and learn to identify with appropriate gender roles. This is expressed in different forms of overt behaviour which manifest in their everyday lives at home, in school and playground activities. According to teachers interviewed, the processes that contribute to girls' under-representation in certain science and technology subjects are complex and closely interrelated. Asked to elaborate on this view, a teacher at a single sex school said the home has got an ideology which is gender biased and:

> *…this explains why when it comes to subject choices at secondary schools, many girls tend to follow a curriculum that excludes science and technology related subjects [STS3].*

While this teacher was talking about girls following subjects that exclude science and technology subjects, another teacher at the same school talks about the home as pressurising schools to allocate subjects along gender lines. The teacher stated:

> *…parents come to school to tell us the subjects which they want their children to pursue (HODM1).*

Another teacher felt that the types of toys children play with at home, such as cars and guns for boys as well as female dolls for girls have a bearing on their choice of subjects later in life. The teacher elaborated thus:

> *Tough toys for boys and soft toys for girls have a bearing on learners' choice of subjects later in life. By the time they come to school, boys would have been socialised to tackle perceived tough subjects such as science and technology while girls are relegated to traditionally female inclined subjects such as Food and Nutrition, Fashion and Fabrics and the arts [STM8].*

Related to the issue of toys that the teacher at a mixed sex school touched on, another teacher at a single sex school had this to say:

> *Boys are, for instance, assigned tough tasks such as wood work, building and mechanical work while girls sweep, cook and sew torn clothes [STS1].*

The above responses show that the home environment gives pressure and schools have no option except to succumb to the strong influence from the family on subjects to be studied by boys and girls at school. The views depict teachers concurring that the home environment, through gender role ideology influences boys to pursue science and technology subjects at school and girls to choose subjects which are considered as more suitable for females such as food and nutrition, fashion and fabrics and the arts. Related research findings from Baki (2004:1) indicate that the socialisation of gender within the family limits women's access to certain subjects at school.

5.9.1.2 Teachers' views and expectations on the curriculum

The views of teachers were solicited in order to glean their understanding and perceptions of how teachers' attitudes and expectations influence learners' access to science and technology subjects along gender lines. Respondents admitted that their attitudes and expectations of boys' and girls' roles mirrored society's gender role expectations of males and females. Blaming the interaction that takes place at school, a class teacher at a mixed sex school said:

> *Some teachers laugh at boys doing arts subjects. Their comments during interaction persuade the boy child to pursue science and technology subjects [CTM1].*

Similar sentiments about teachers' attitudes and expectations towards curriculum for boys and girls were also expressed by a teacher at a single sex school who felt that:

> *Teachers' comments or statements that boys are not expected to fail science and technology subjects do not put boys and girls at equal footing in terms of choice of subjects [CTS5].*

In the same vein, another teacher at a mixed sex school concurred with the view that the school, as a sub-system of society tends to repeat and instil the cultural norms and values from the family by socialising girls to believe that they are unequal to boys. The teacher revealed that:

> *… through interaction, male superiority and female inferiority notions that are rooted in the family are instilled in boys and girls at school. Negative comments towards girls make them aware that they are unequal to boys and that tends to lower their confidence to pursue science and technology subjects [STM3].*

The HOD of a mixed sex school expressed her unhappiness with teachers who comment positively about boys who choose to study science and technology subjects but do the opposite about the girl child. Such teachers, according to the HOD boost the self-esteem of the boy child while lowering that of the girl child. She said:

> *With boosted self-esteem, boys tend to prefer science and technology subjects while girls opt for arts, commercials and domestic science subjects. Therefore, schools create uneven playing fields in terms of subject choices [HODM1].*

These sentiments depict that teachers' attitudes and expectations towards boys and girls at school are influenced by cultural norms and values of the society in which they live. Thus, the gender socialisation that makes girls aware that they are unequal to boys permeates within the school culture. Teachers' attitudes and expectations that boys are better than girls in science and technology subjects at school mirror the gender role socialisation that takes place at home. Therefore, schools have no option but to follow in the footsteps of the home environment because teachers are products of the society which they live. Ultimately, the socialisation of gender perpetuated at school through interaction tends to limit girls' access to science and technology subjects. The teachers' views buttress the contention of this study's theoretical framework that, if gender stereotyping is repeated regularly, it solidifies and becomes difficult to uproot from mental frames of people (Njogu & Orchardson-Mazrui, 2015:2). Therefore, boys' and girls' exposure to the gendered social world tend to influence their access to and performance in science and technology subjects at school.

5.9.1.3 Gender socialising agents in science and technology

Participants were requested to express their opinions with regards to the influence of socializing on boys' and girls' choice of subjects at school. It emerged that socializing agents such as the family, peers, media and the school negatively influence boys' and girls' access to different subjects offered at school including science and technology. A class teacher at a mixed sex school revealed that:

> *Parents also choose subjects for their children. Due to gender role socialisation, they perceive boys as more capable than girls and encourage them to pursue science subjects [CTM9].*

While this class teacher talks of parental involvement in the choice of subjects by boys and girls, another teacher at the same school talks about peers as a pressuring factor that influences boys' and girls' choice of subjects at school. The teacher said:

> *Due to the effects of gender role socialisation, some learners especially, girls encourage their female counterparts to shun science and technology which are perceived to be difficult in favour of domestic science subjects and arts [DHM].*

While the deputy head at the same school views peer influence as responsible for differential access to science and technology subjects, another teacher at a single sex school perceives the media as responsible for channelling boys and girls to different subjects at school. The teacher had this to say:

> *The media portrays men engaging in outdoor activities while women are shown as more of caregivers in the home. That is likely to affect learners' choice of subjects with boys opting for science and technology while girls are settling for domestic science and the arts [STS4].*

The above views indicate that parents, peers, schools and the media are powerful vehicles for socialising children and affect their choice of subjects. Through gender role socialisation, socialising agents influence girls to pursue domestic science subjects and boys to choose science and technology subjects. This is caused by the superiority mentality inculcated in boys that they can tackle science and technology subjects better than girls who are perceived as weak. These results concur with earlier studies by Kerkhoven et al, (2016:2) who found out that gender role socialisation instils inferiority values in girls, resulting in them becoming less confident to select science and technology subjects at school.

5.9.1.4 Influence of job opportunities on engendering science and technology

Some participants who were interviewed cited job opportunities as one of the factors influencing boys' and girls' access to science and technology subjects at school. They indicated that learners are more concerned about the availability of jobs and salaries which the jobs offer. The HOD of a single sex school proffered the following views:

> *Nowadays, science and technology subjects are associated with better job opportunities in Zimbabwe, hence more people are drifting towards pursuing the subjects [HODS2].*

While the HOD of a single sex school talked about job opportunities, another teacher at the same school indicated that parents and learners are more interested in the good salaries that science and technology related careers offer. The teacher stated that:

> *…the careers associated with science and technology related subjects offer good salaries [CTS1].*

A third teacher at the same school pointed out that science and technology related careers give someone a good status in society. He revealed that:

…jobs associated with science and technology subjects are prestigious (STS1).

In view of the above contributions by teachers, it is evident that the desire to easily secure well-paying and prestigious jobs has provided an impetus for learners to choose science and technology subjects at school. The learners' aspirations for prestigious jobs could be motivated by the desire for a better living as posited by Mbugua, Kibet, Muthaa and Nkonke (2012:87) who state that science subjects, including Mathematics are for prestigious courses such as medicine, architecture and engineering among other degree programmes which guarantee prestigious jobs with high salaries. This means that learners have to work very hard to pass the science subjects in order to secure prestigious jobs. Therefore, the desire for good life has been identified as a motivating factor for both boys' and girls' access to science and technology subjects at schools.

5.9.2 Theme 2: Factors Influencing Performance in Science and Technology

Respondents were asked to present their responses on factors that influence boys' and girls' performance in science and technology subjects at school. Included in the following discussion were heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers at a single sex and a mixed sex school.

5.9.2.1 Family Support on gender differentiation in science and technology

Interviews with participants revealed that parents play a role in supporting their children by motivating them to excel in various subjects, including science and technology. However, parents also play a role in inculcating gender role socialisation which influences the girl child's performance in science and technology subjects at school. A teacher at a mixed sex school had this to say:

The differential social roles that make boys handle tough outdoor activities such as building while girls perform domestic chores tend to *boost boys' confidence and perform better than girls in perceived tough subjects such as science and technology [CTM7].*

While the above teacher talks about the home environment as influencing boys and girls to perform differently in science and technology subjects through gender role socialisation, another teacher at the same school talks about the positive role played by parents in providing children with educational materials and motivating them to excel in various subjects including science and technology. The teacher stated that in the subjects that boys and girls had freedom to choose:

…parents simply support them to work hard and achieve. In addition to providing them with educational materials, they also motivate them to achieve in all subjects including science and technology [CTM5].

Like the first teacher at a mixed sex school who blamed gender role socialisation for differential achievement in science and technology subjects, a teacher at a single sex school also expressed unhappiness with the way the home environment, through gender role socialisation portrays boys as superior to girls.

The teacher said boys tend to perform better than girls in science and technology subjects at school because:

…some parents openly tell the boy child that he is the head of the family. As a result of being portrayed as superior, boys are expected to perform better than girls in science and technology subjects [CTS8].

The above accounts indicate that parents' support for their children is in the form of providing them with educational materials as well as motivating them in all subject areas including science and technology. However, the gender role socialisation at home instilled a superiority mentality among boys which gives them an advantage over girls when it comes to performance in science and technology subjects. The statements by teachers correlate with findings by Kambarami (2006:3) who contend that the family is a social institution is a 'brewery' for patriarchal practices by socialising the young to accept sexually differentiated roles. This means that the family creates an uneven playing field in terms of boys' and girls' performance in science and technology subjects. With boosted self-esteem, boys tend to work harder and perform better than girls in science and technology subjects.

5.9.2.2 Teachers' classification of knowledge on gender lines

The views of heads of schools, their deputies, science and technology subjects HODs, science and technology class teachers and science and technology subject teachers were solicited. The idea was to ascertain their understanding of teachers' classification of knowledge on gender lines at school. The influence of teachers' attitudes and expectations on boys' and girls' performance in science and technology subjects at school was unpacked. Teachers have been linked to the perpetuation of gender role socialisation which gives boys performance advantage compared to girls in science and technology subjects.

A teacher at a single sex school had this to say:

> *Teachers' comments and portrayal of girls as inferior at school reinforce patriarchy. Boys tend to gather confidence resulting in them performing better than girls [CTS7].*

Similar sentiments were expressed by another teacher at the same school who stated that:

> *Through comments, teachers expect boys to perform better than girls [STS6].*

In the same vein, a teacher at a mixed sex school also agreed that there is gender role socialisation at school which results in differential performance between boys and girls. He explained:

> *Due to gender role socialisation at school, boys tend to perform better than girls in science and technology subjects. Teachers' comments like 'Science and technology subjects are for boys not girls because they are difficult' encourage boys to perform better than girls [STM5].*

It is evident from the above findings that teachers classify knowledge along gender lines. Through their attitudes and expectations of boys and girls, teachers engender, reinforce and reproduce patriarchy at school. They create a notion of male superiority over female, as a result of the gender role socialisation pervasive at school. These observations are consistent with the symbolic interactionism theory's contention that, it is through symbolic interactionism that boys' and girls' awareness about themselves in terms of their genders is raised rather than knowing themselves in terms of being 'people' (Hewitt, 2002:4). This implies that the gendered school culture is responsible for differential performance in science and technology subjects at school.

5.9.2.3 Social construction of school performance

Teachers' views were sought with regards to the role played by society in the construction of school knowledge. It emerged from the interviews that socialising agents such as the family, peers, mass media and schools entrench gender role socialisation which is propagated at an early age. The deputy head of a single sex school felt that the gender role socialisation perpetuated by socialising agents results in differential performance in science and technology subjects at school. Giving an example of the family, she expressed:

> *...differential treatment at home tends to translate to differential performance in science and technology subjects at school. Different toys and duties allocated to boys and girls at home negatively influence girls' performance in the subjects at school. Boys tend to have more confidence in tackling science and technology related subjects than girls [STM4].*

A single sex school teacher who shared the same sentiments with her mixed sex school counterpart, gave an example of the media which she felt perpetuate gender role socialisation resulting in differential performance in science and technology subjects. She said:

> *The media portrays boys as tough and engaging in rough type of play while girls are shown as gentle and soft. That tends to boost confidence in boys resulting in them performing better than girls in science and technology subjects [STS2].*

While the two teachers above talked about the role of the media and parental involvement on learners' differential performance in the subjects, another teacher at the mixed sex school talked about the negative influence peers might have on boys' and girls' performance in science and technology subjects at school. Relating his first-hand experience with learners, the teacher said:

> *A certain girl at this school had a low mid-year exam mark and her friends were teasing her. They told her that, they warned her to leave science subjects in favour of arts which are easy but she resisted [CTM1].*

Another teacher divulged that he used to give adverse comments to girls who chose to pursue science and technology subjects at school. Consequently, their performance dropped compared to their male counterparts. The teacher explained:

> *I used to give encouraging comments to boys doing science and technology subjects at this school but saying nothing to girls. That tended to negatively affect girls' level of achievement in the subjects as compared to boys. I have since stopped saying damaging comments to learners [STM2].*

The common idea running through these excerpts is that the patriarchal ideology communicated via the socialising agents has resulted in boys performing better than girls in science and technology subjects at school. According to the theoretical framework employed in this study, individuals tend to react in terms of their self-concepts as communicated to them by significant others such as parents, teachers or peers (Turner, 2004:343). Therefore, in a gendered social world, learners tend to be influenced to perform differently in science and technology subjects at school.

5.9.2.4 Influence of job market on engendering science and technology

Respondents identified the job market as one of the factors influencing school performance in science and technology subjects at school. They said science and technology subjects give them easy passage to careers with good salaries. An HOD at a single sex school responded:

> *Learners cast their nets wider to easily access good jobs without hassles. So, the answer to this is to perform well in science and technology subjects [HODS1].*

The influence of the job market was also emphasised by another HOD at the same school who said:

> *With science and technology, learners know that they won't struggle to get vacancies at higher learning institutions and also in securing employment later in life [HODS2].*

While the two HODs talked about ease access to jobs, another teacher at a mixed sex school indicated that parents and learners are more interested in lucrative salaries that science and technology related careers offer. The teacher revealed that:

> *Careers associated with science and technology related subjects offer both prestige and good salaries [CTM2].*

The excerpts above illustrate the need for learners to take an active role and work hard if they are to produce any meaningful outcomes in science and technology subjects. Thus, zeal to succeed is the cardinal factor that propels them to realise their dreams. These findings are buttressed by literature which echoes that achievement in science and technology subjects plays a vital role in the development of human capital and is linked to an individual's well-being and opportunities for better living (Farooq, Chaudhry, Shafiq & Berhanu, 2011:1).

The above scholars stress that achievement in the subjects ensures the acquisition of knowledge and skills that enable individuals to increase their productivity as well as their quality of life.

5.9.3 Theme 3: The School as a Gender Socialising Agent of Masculinity and Femininity through Science and Technology

Respondents were required to air their views with regards to the role of the school as a gender socialising agent of masculinity and femininity. The theme sought to uncover the school's role in ensuring gender sensitivity in term of boys' and girls' access to and performance in science and technology subjects.

5.9.3.1 Subject channelling on gender lines

The views of respondents with regards to schools' subject channelling on gender lines were sought. Interviewees revealed that they do not channel subjects on gender lines because they do not believe that there are subjects best suited for boys and others best suited for girls. However, they acknowledged that subject channelling may take place in a subtle way or via the hidden curriculum. The deputy head at a single sex school had this to say:

> *I do not remember myself channelling subjects along gender lines because I do not believe that there are subjects best suited for boys and some best suited for girls. However, I do not rule out the possibility that we as teachers have done it since we are products of the gender role socialisation in the societies we live [DHS].*

Similar sentiments were expressed by another teacher at a mixed sex school thus:

> *Teachers may channel subjects on gender lines in a subtle way. Generally, we believe that there are no subjects best suited for boys and others best suited for girls but our comments as we interact with learners at school give the impression that girls are not at par with boys in terms of performance in science and technology subjects. That is tantamount to encouraging boys not only to pursue science and technology subjects at school, but also to perform better in the subjects [STM7].*

Another teacher at a mixed sex school confirmed that teachers may channel subjects on gender lines in a subtle way. The teacher said:

> *I believe in equality between men and women but if there is any subject channelling on gender lines at school, its occurrence may be through the hidden curriculum. During teacher-learner interaction at school, teachers may reproduce male domination without realising it [CTM4].*

All the three excerpts above illustrate that while teachers claim to believe in equality between men and women in the private and public spheres of life, they did not deny that they do not afford girls opportunities for competing on an equal footing with their male counterparts in terms access to and performance in science and technology subjects. Subject channelling along gender lines occurs in a subtle way through comments which teachers make during their interaction with learners or via the hidden curriculum. Thus, teachers can be regarded as agents of channelling school subjects on gender lines by failing to afford boys and girls equal opportunities to navigate in science and technology subjects at school.

It could be argued the notion that men are superior to women is embedded in the school environment. This renders the school environment gender insensitive in relation to boys' and girls' access to and their performance in science and technology subjects. Therefore, there is need to deconstruct such a mentality if gender neutrality in terms of boys' and girls' access to and their performance in science and technology subjects is to be realised. The above teachers' views on subject channelling along gender lines support previous findings by Kentli (2009:83) who observes that the hidden curriculum has for a long time been acknowledged as the socialisation process responsible for differential treatment of students at school.

5.9.3.2 The school as an agent for gender equality in science and technology

Heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers were asked to present their views about the role of schools in promoting gender equality in science and technology subjects. A class teacher at a mixed sex school pointed out that, schools do not give boys and girls equal chances to study science and technology subjects. The teacher said:

> *Our school is better because it is a mixed sex institution. A single sex school where my daughter is attending does not offer Building, Wood Work, Metal Work and Technical Graphics. This shows that schools are denying girls an opportunity to pursue these subjects [CTM8].*

Another teacher at the same school echoed the same sentiments thus:

> *While we offer Building, Wood Work, and Technical Graphics at our mixed sex school, Agriculture is the only technology related subject offered at our neighbouring single sex school. This denies the girl child an opportunity to access other subjects such as Technical Graphics, Wood Work, Metal Work and Building [CTM9].*

A third teacher at a mixed sex school also lamented the absence of certain technology related subjects at schools thus:

> *…our school does not offer metalwork and that denies not only the girl child, but also the boy child an opportunity to access the subject [CTM7].*

It is evident from the views of all teachers interviewed above that the school is an agent for gender inequality in science and technology related subjects. By not offering other science and technology related subjects, the mixed sex and single sex schools have exposed their gender insensitivity in the teaching and learning of science and technology subjects. This study is not talking about boys being disadvantaged because the issue is not about boys, but girls who are under-represented and under-achieving in perceived male dominated subjects (Miroux, 2011:7). Therefore, the idea is to uplift girls and give them an opportunity to access and perform in science and technology subjects at the same wavelength with boys. It can be concluded that the gender role socialisation which favours men at home and filters through the school culture may have influenced the school authorities to deny the girl child an opportunity to study certain technology related subjects especially at a single sex school (Lei, 2006:87).

5.9.3.3 School differential career counselling and treatment of boys and girls

This sub-theme sought to ascertain if schools treat boys and girls equally when giving career advice. Teachers revealed that there is no school differential career cancelling and treatment of boys and girls. The HOD of a mixed sex school stated that:

> *We don't treat them differently. We tell them that anybody can do any job regardless of gender [HODM1].*

A class teacher at the same school had similar views. He said:

> *We treat them equally irrespective of their sex. We let them know that what matters is capability rather than gender [CTM2].*

A similar view was expressed by another teacher at the same school thus:

> *We give our learners the same treatment on career advice. We believe in equality [STM1].*

It is clear from the above statements that teachers do not discriminate learners on the basis of gender when giving career advice. These findings contradict previous literature which states that there are gender inequalities in schools in terms of subject preferences and career choices (EC, 2009:3).

5.9.3.4 School differentiated responsibilities for boys and girls

This section sought respondents' views on the nature of tasks assigned to boys and girls by schools. It emerged that schools differentiate responsibilities along gender lines. A mixed sex school teacher revealed that:

> *Sweeping and light tasks like picking up papers around the school are done by girls while table carrying, movement of heavy furniture and tough tasks are carried out by boys [STM7].*

While the teacher interviewed above specified the different tasks assigned to boys and girls at school, another teacher at the same school was silent about the specific tasks assigned to both sexes. The teacher explained that:

> *Boys are assigned to carry out heavy tasks while girls are given light tasks [STM5].*

A third teacher at the same school suggested that tasks performed by boys and girls are carried out on a voluntary basis. The teacher said:

> *If we want them to help us, boys volunteer to carry or arrange heavy furniture while girls prefer to perform light tasks like sweeping [STM3].*

The above accounts confirm that schools differentiate responsibilities by assigning tough tasks such as the lifting of heavy furniture to boys while light duties like sweeping are given to girls. By portraying boys as more powerful than girls, schools help to entrench the inferiority mentality in girls, thereby affecting their choice of subjects as well as their performance in science and technology. Thus, the gendered school environment tends to affect girls' access to and their performance in science and technology subjects (Mutekwe & Modiba, 2015:1).

5.9.3.5 School 'gender typification' of performance in science and technology

Heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers were asked to present their responses about the performance of boys and girls in science and technology subjects at schools. They indicated that nowadays boys' and girls' performance in science and technology subjects is at par. A mixed sex class teacher elaborated thus:

> *Performance is at par. Boys and girls perform the same at both 'O' and 'A' Levels [CTM2].*

Another teacher at a mixed sex school concurred with the view that nowadays boys' and girls' performance in science and technology subjects is at par. The teacher said:

A third teacher at the same school echoed the same sentiments by saying:

> *It is sometimes a see-saw but basically the performance of boys and girls in science and technology subjects at schools is at par [STM6].*

The above quotes illustrate that there is no sex that absolutely performs better than the other in science and technology subjects at school. Teachers' perceptions contradict with earlier studies by Koirala and Acharya (2005:18) who found that, boys' and girls' access to and their performance in science and technology subjects was in favour of boys at school.

5.10 CHAPTER SUMMARY

This chapter presented and analysed quantitative data gathered through questionnaire schedules and school documents, specifically the 2016 – 2017, 'O' and 'A' Level final national examinations results. Descriptive statistical analysis was used to draw conclusions from gathered quantifiable data using chi-square (Figures 5.19-5.24 & Tables 5.4-5.6) and binomial tests (Tables 5.1-5.3) to find out if there was any significant difference in terms of boys' and girls' access to and their performance in science and technology subjects at school. Statistical tests compared girls at a single sex and a mixed sex school as well as boys and girls learning together at a mixed sex school. The tests also compared boys at a mixed sex school and girls at a single sex school.

Quantitative findings from school documents namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, revealed that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). The null hypothesis which claimed that there is no significant difference in terms of single sex and mixed sex school girls' access to science and technology subjects at school was therefore rejected.

In terms of numbers (Table 5.1), the single sex school girls also had higher access to science and technology subjects in all 'O' and 'A' Level subjects (Table 5.1). This is evidenced by the following enrolment figures: 'O' Level Physics (93/40), Chemistry (97/43), Agriculture (86/22), Mathematics (253/221) and Integrated Science (242/220) as well as 'A' Level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). One of the factors that might have caused more access to science and technology subjects by single sex school girls than their mixed sex school counterparts is the sharing of space in mixed sex schools. The absence of gender competition tends to give single sex school girls an advantage over mixed sex school female learners in terms of access to science and technology subjects at school.

With regards to subjects offered (Table 5.1), it was established that mixed sex school girls had more subjects taught at their school and therefore, had more access. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building as compared to Mathematics, Physics, Chemistry, Integrated Science and Agriculture taught at a single sex school. This observation is supported by more single sex school girls 74/81(91%)-7/81(9%) than their mixed sex school counterparts 47/59(80%)-12/59(20%) whose perceptions were that there were science and technology subjects that they wanted to study but were not taught at their school (Figure 5.11). In light of these findings, schools can to a certain extent, be viewed as channelling subjects along gender lines because they do not avail some of the science and technology subjects which were traditionally regarded as male inclined and offered more to boys than girls. Channelling subjects along gender lines is against the 1999 Science Agenda-Framework for Action of the UNESCO World Conference on Science (WCS) which called for special efforts by governments and the civic society to ensure the full participation of women and girls in all aspects of science and technology (UN, 2010:5).

On performance (Table 5.4), statistical findings from school documents namely, the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results, depicted significant difference ($p<0.05$) in favour of single sex school female learners. The null hypothesis which claimed that there was no significant difference in terms of single sex and mixed sex school girls’ performance in science and technology subjects at school was therefore rejected. This finding is expected given the fact that there is gender competition in a mixed sex school which tends to give an advantage to single sex school girls over their mixed sex school counterparts in terms of performance in science and technology subjects.

With regards to boys and girls learning together at a mixed sex school, statistical findings on access (Table 5.2) to science and technology subjects from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results revealed significant difference ($p<0.05$) in favour of boys. Similar findings emerged from mixed sex school boys’ and girls’ perceptions from the questionnaire instrument (Figure 5.20) whose statistical results (chi-squared value = 27.77, df = 1, $p< 0.05$) depicted significant difference in favour of boys. Overall, the significant difference in terms of access was in favour of boys. In view of this finding, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected.

In terms of enrolment figures (Table 5.2), boys were more than girls in ‘O’ Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in Mathematics (198/221) and Integrated Science (205/220) subjects only. In all comparable ‘A’ Level subjects namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects as compared to girls. The reason for this finding is the gender competition for access at a mixed sex school that tends to disadvantage girls as compared to boys.

On subjects offered (Table 5.2), the study revealed that both mixed sex school boys and girls had access to all subjects which formed the scope of this study except building. These are: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building.

Statistical findings from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results on performance (Table 5.5) between boys and girls learning together in a mixed sex school, revealed no significant difference ($p>0.05$). The reason for this finding may be increased efforts by the AU member countries which set up the AU’S Gender Advisory Board (GAB) in 2005 which compelled all AU governments to promote gender equity in science and technology education (UN, 2011:2). Due to such efforts, gender disparity in terms of boys’ and girls’ performance in science and technology related subjects may be decreasing.

Statistical findings from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results, established significant difference (Table 5.3) ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys. Similarly, statistical tests (chi-squared value = 10.46, df = 1, $p < 0.05$) from mixed sex school boys’ and single sex school girls’ perceptions based on the questionnaire instrument (Figure 5.21) revealed significant difference which was in favour of girls. Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: 'O' Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93). The reason for this finding is that mixed sex school boys compete for access with girls while single sex school girls compete on their own. This tends to give an advantage to girls learning on their own in terms of access to science and technology subjects at school.

In terms of subjects offered (Table 5.3), it emerged that mixed sex school boys had more access as they were exposed to more science and technology related subjects than girls at a single sex school. The mixed sex school taught Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building while the single sex school offered Mathematics, Physics, Chemistry, Integrated Science and Agriculture. This finding is corroborated by the majority of single sex school girls 74/81(91%)-7/81(9%) compared to mixed sex school boys 16/53(30%)-37/53(70%) who felt that there were science and technology subjects they wanted to study but were not offered at their school (Figure 5.11).

In view of these findings, the school setting can to a certain extent be regarded as lacking gender neutrality because it promotes gender differential access to science and technology subjects which were traditionally regarded as male defined and offered more to boys than girls. Differential channelling of subjects along gender lines is not in line with the 2008 call of the Commission on the Status of Women (CSW) for renewed gender parity to be given to education in terms of girls' and women's access to information technology, mathematics as well as science and technology (UN, 2010:5, Debusscher, 2015:6).

Performance results from single sex school girls and mixed sex school boys using school documents, namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results depicted significant difference that favoured single sex school girls (Table 5.6). In the same vein, statistical results from learners' perceptions based on the questionnaire instrument (chi-square = 10.398, df = 1, $p < 0.05$) showed significant difference in favour of single sex school girls (Figure 5.24).

In light of these findings from the two data sets, it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls' and mixed sex school boys' performance in science and technology subjects at school is thus rejected. Competition by gender that boys at the mixed sex school are exposed to tends to be the reason for this finding. As a result, single sex school female learners who compete among themselves tend to have an advantage over mixed sex school boys in terms of performance in science and technology subjects.

The chapter also presented qualitative data gathered through interviews. Data from interviews were interpreted using content analysis. The analysis was based on themes and patterns that emerged from data gathered through interaction with respondents. The interviews sought educators' views on factors that could influence learners' access to and their performance in science and technology subjects at school. Teachers at the mixed sex and single sex schools were requested to respond to questions on factors that could promote gender inequalities in the teaching and learning of science and technology subjects in schools. Data were analysed in accordance with the three delineated but interrelated themes namely, factors influencing access to science and technology along gender lines, factors influencing school performance in science and technology along gender lines and the school as a gender socialising agent of masculinity and femininity in science and technology.

Some factors that influence access to science and technology subjects along gender lines were identified. The study revealed that the home has an ideology which is gender biased in favour of men. This was revealed by respondents who pointed out that the types of toys that children are exposed to at an early age and the division of labour reinforce a gendered belief that boys are more powerful and superior than girls.

According to the symbolic interactionism theory, the idea of the self, where children know themselves in terms of being ‘boys’ or ‘girls’ rather than ‘people’ is developed through daily experiences and observations (Mutekwe & Mutekwe, 2012:196). It is the gender differentiation in society that tends to influence boys to pursue science and technology subjects while girls settle for domestic science subjects and the arts.

It emerged that teachers help to track boys into science and technology subjects while relegating girls to commercials, arts and domestic science subjects. Interviews revealed that, teachers pass positive comments to boys doing science and technology subjects but do the opposite to girls pursuing the same subjects. This boosts the confidence of boys, resulting in them opting to study science and technology subjects. With low confidence, girls would settle for domestic science subjects and the arts. Thus, teachers’ attitudes and expectations of boys and girls can result in learners’ differential access to the subjects.

Socialising agents influence girls to pursue domestic science subjects and boys to study science and technology subjects at school. It was evident from interviews that some female learners discourage other girls from pursuing science and technology subjects. Again, teachers revealed that, parents put pressure on their male children to pursue science and technology subjects at the expense of girls. Furthermore, teachers noted that the media portray men engaging in outdoor activities while women are shown as more of caregivers. All these result in boys’ and girls’ differential access to science and technology subjects at school.

The study demonstrated that learners’ desire to easily secure well-paying and prestigious jobs is another factor influencing their access to science and technology subjects. Teachers indicated that learners are more concerned about the availability of good jobs and salaries which the jobs offer more than anything else. Therefore, their access is motivated by the desire for better life.

On performance, the study found out that, patriarchal practices in the family result in boys performing better than girls in science and technology subjects at school. Interviewed teachers indicated that assigning different tasks to boys and girls portrays girls as weak and inferior to boys. The gender role socialisation which is a product of patriarchal practices, tends to boost boys' confidence resulting in them performing better than girls in science and technology subjects.

It emerged from the study that teachers expect boys to perform better than girls in science and technology subjects at school. Teachers felt that there is gender role socialisation at school that creates a notion of male superiority over females but were doubtful whether that can affect performance between boys and girls. Teachers were unanimous that through comments, they expect boys to perform better than girls though the situation on the ground may be different.

The study revealed that patriarchal ideologies that favour boys result in boys performing better than girls. Teachers believed that there are patriarchal ideologies embedded in society such as the practice of giving different toys to boys and girls at home, media bias, as well as negative peer influence. Teachers pass positive comments to boys pursuing science and technology subjects and do the opposite to girls studying the same subjects. According to teachers, patriarchal ideologies which portray boys as more capable than girls in science and technology are responsible for their differential performance in the subjects. Earlier studies have also shown that patriarchal practices which infiltrate into social institutions, including education are responsible for portraying men as superior to women in the private and public spheres of life (Kambarami, 2006:4). Consequently, boys are perceived to perform better than girls in science and technology subjects at school.

It emerged from the study that learners pursue science and technology subjects so that they can have easy passage to careers with good salaries. Teachers felt that learners take an active role and work hard to produce good results in science and technology subjects because of the need to secure good jobs with lucrative salaries later in life. Therefore, good passes are needed to secure vacancies at higher learning institutions.

The study also extracted responses with regards to the school's role in ensuring gender sensitivity in terms of boys' and girls' access to and performance in science and technology subjects. The study gathered that, teachers view science and technology subjects as best suited for boys than girls. Teachers indicated that subject channelling takes place in a subtle way or via the hidden curriculum without any awareness of its occurrence by anyone at school. They revealed that, subject channelling occurs during teacher-learner interaction or via comments which give an impression that girls are not at par with boys in terms of performance in science and technology subjects. They admitted that they are biased in favour of boys in terms of access to and performance in science and technology related subjects.

It emerged from the study that schools give an advantage to boys when it comes to giving boys and girls opportunities to study science and technology subjects. Teachers pointed out that some schools, especially single sex schools are not offering subjects like Technical Graphics, Wood Work, Metal Work and Building thereby denying the girl child an opportunity to study them. They also noted that even mixed sex schools do not offer certain subjects, thereby denying learners an opportunity to pursue the subject. Thus, schools can be regarded as playing a role in subject channelling along gender lines.

The study revealed that schools treat learners equally when giving career counselling. Interviewed teachers insisted that schools do not treat learners differently when giving career counselling. Teachers concurred that they are gender sensitive when giving career advice to learners at school. They emphasised that discrimination when giving career counselling is not necessary.

The study found out that schools assign tough tasks to boys and light tasks to girls. Teachers indicated that schools differentiate responsibilities for boys and girls by assigning tough tasks such as the lifting or arranging of heavy furniture to boys and light duties like sweeping or picking up papers to girls. By so doing, they portray boys as more powerful than girls, thereby entrenching the inferiority mentality in girls which tends to affect not only their choice of subjects, but also their performance in science and technology.

The study demonstrated that, the performance of boys and girls in science and technology subjects is at par. The common feeling among teachers was that there is no gender that performs better than the other.

CHAPTER SIX

DISCUSSION OF RESULTS

6.1 CHAPTER INTRODUCTION

In the previous chapter, a presentation of data gathered from the participants of the study was made. Quantitative data were gathered through questionnaire guides and school documents namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results while qualitative data were gathered through interviews. After presenting data from questionnaires and school documents using chi-square and binomial tests, descriptive and inferential statistical analysis were then employed to draw conclusions from quantifiable data with regards to the nature of boys' and girls' access to and their performance in science and technology subjects at single sex and mixed sex schools. Narrative data collected from interviews were interpreted using content analysis. This chapter presents a summary of the study findings based on quantitative data gathered through questionnaire guides and school documents namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results. The chapter also presents a summary of the study findings based on qualitative data gathered through interviews.

The main aim of this study was to examine how gender socialisation affects boys' and girls' access to and their performance in science and technology subjects. The study sought to determine and explore factors that could influence access to and performance in science and technology subjects by boys and girls at a single sex and a mixed sex schools in Zimbabwe.

The study was a mixed method study with a convergent parallel design. It was underpinned by the pragmatic philosophical world view. It was informed by the symbolic interactionism theory which contends that the meanings that individuals come to perceive themselves in terms of their choice of subjects at school are socially constructed, developed and modified during interactions and not socially predetermined. This study had two samples; one for the quantitative strand and the other for the qualitative strand. The probability stratified random sampling method was adopted for the quantitative sample size. It comprised of 112 boys and girls from a mixed sex school and 81 girls from a single sex school. The qualitative sample size from the two study sites was purposively selected. The sample at the mixed sex school consisted of 1 head of school, 1 deputy head, 2 science and technology subjects HODs, 11 science and technology subjects class teachers and 8 science and technology subject teachers. The sample at a single sex school comprised of 1 head of school, 1 deputy head, 2 science and technology subject HODs, 10 science and technology subjects class teachers and 7 science and technology subject teachers. Quantitative data analysis was done statistically using chi-square and binomial tests while qualitative data from interviews were analysed thematically and in purely descriptive form. Quantitative and qualitative results were presented separately before merging them to compare, contrast and corroborate results from the two strands. The merged findings were then discussed by placing them in the broader context of existing related literature.

6.2 MAJOR FINDINGS FROM QUANTITATIVE DATA

Chi-square and binomial results on views of learners with regards to their access and performance in science and technology subjects were derived from questionnaires which were administered to 193 randomly selected form 1-6 learners at a single sex school and a mixed sex school. The mixed sex school sample comprised of 112 learners. Of these, 53 were boys while 59 were girls. The sample at a single sex school consisted of 81 girls. Chi-square and binomial results on boys' and girls' access and performance in science and technology subjects were also derived from school documents namely: ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results. These were the first to be discussed under quantitative objectives one, two and three, followed by qualitative results. Just like on access, chi-square results on performance compared girls at a single sex school with both boys and girls learning together at a mixed sex school. A comparison of boys and girls learning together at a mixed sex school was also undertaken.

It is imperative to point out that, where results differed, I considered findings from secondary data (2016 – 2017, 'O' and 'A' Level final national examinations results) more than those from primary data (questionnaires). I did that because secondary data gave me real figures and objective findings on access and performance while primary data were mainly on learners' perceptions. Consequently, I derived absolute findings impartially with regards to boys' and girls' access to and their performance in science and technology subjects (Livesey, 2011:1).

6.2.1 Quantitative Objective 1: To Establish if there is any Significant Difference in Access to and Performance of Girls in Science and Technology Subjects at Single Sex and Mixed Sex Schools

Quantitative findings from school documents namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, revealed that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). The null hypothesis which claimed that there is no significant difference in terms of single sex and mixed sex school girls' access to science and technology subjects at school was therefore rejected.

The single sex school girls have higher access to science and technology subjects in all 'O' and 'A' Level subjects (Table 5.1). This is evidenced by the following enrolment figures: 'O' Level Physics (93/40), Chemistry (97/43), Agriculture (86/22), Mathematics (253/221) and Integrated Science (242/220) as well as 'A' Level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). These findings dovetail with the majority of single sex school female learners' perceptions 74/81(91%)-7/81(9%) who revealed that they have the desire to study science and technology subjects if they are given an opportunity (Figure 5.10). Although the majority of mixed sex school girls 56/59(95%)-3/59(5%) also felt the same, the percentage of single sex school girls' perceptions is sufficient to corroborate their superior access to science and technology subjects compared to mixed sex school girls. An observation to make from these results is that single sex school girls compete on their own for access to science and technology subjects while in mixed sex school girls compete with boys. This gives single sex school girls an advantage over their mixed sex school counterparts.

With regards to performance, statistical findings from school documents, namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, (Table 5.4) depicted significant difference ($p<0.05$) in favour of single sex school female learners.

The null hypothesis which claimed that there was no significant difference in terms of single sex and mixed sex school girls' performance in science and technology subjects at school was therefore, rejected. The obvious reason for this is that in a single sex school, all learners are girls who compete among themselves while in a mixed sex school girls compete with boys. The presence of boys disadvantages girls, resulting in them performing lower than their single sex school counterparts.

6.2.2 Quantitative Objective 2: To Find out if there is any Significant Difference in Access to and Performance in Science and Technology Subjects for Boys and Girls in Mixed Sex Schools

With regards to boys and girls learning together at a mixed sex school, statistical findings on access to science and technology subjects from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results depicted significant difference ($p<0.05$) in favour of boys (Table 5.2). Similar findings emerged from the mixed sex school boys' and girls' perceptions from the questionnaire instrument (Figure 5.20) whose statistical results (chi-squared value = 27.77, df = 1, $p< 0.05$) revealed significant difference in favour of boys. Overall, the significant difference in terms of access is in favour of boys. In view of this, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected.

In terms of enrolment figures (Table 5.2), boys were more than girls in 'O' Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in Mathematics (198/221) and Integrated Science (205/220) subjects only. In all comparable 'A' Level subjects namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects as compared to girls.

With regards to these findings is the gender competition for access at a mixed sex school that tends to disadvantage girls as compared to boys. This finding indicates that there is competition for access between boys and girls that gives an advantage to boys than girls.

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results on performance (Table 5.5) between boys and girls learning together in a mixed sex school, revealed no significant difference ($p>0.05$). This finding contradict the study's theoretical framework which contends that individuals are influenced to perform differently in science and technology subjects at school due to the inferiority label for girls and the superiority one for boys that is constructed at home and entrenched at school (Patowary, 2014:84). Instead of fulfilling the labels, the finding above indicates that the performance of boys and girls learning together is at par.

The reason for this finding could be the efforts of the 1995 Beijing Platform for Education (BPFA), which called upon governments and all stakeholders to increase women's access to and performance in in science and technology (Debusscher, 2015:20, SARDC, 2016:38; UN, 2010:4). This culminated in the formulation of the 2004 national Gender Policy in Zimbabwe which advocated for gender parity in the private and public spheres of life.

6.2.3 Quantitative Objective 3: To Establish if there is any Significant Difference in Access to and Performance in Science and Technology Subjects between Boys in a Mixed Sex and Girls in a Single Sex School

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls more than mixed sex school boys (Table 5.3). Similarly, statistical tests (chi-squared value = 10.46, df = 1, $p < 0.05$) from mixed sex school boys' and single sex school girls' perceptions based on the questionnaire instrument (Figure 5.21) revealed significant difference which was in favour of girls. Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: 'O' Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93). The possible reason for this finding is that in a single sex school, all learners are girls who compete for access on their own while in a mixed sex school, gender competition is a major factor to consider. It is likely that the presence of girls in a mixed sex school disadvantages boys compared to single sex school girls in terms of access to science and technology subjects.

Results from single sex school girls and mixed sex school boys obtained from school documents, namely: ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results depicted significant difference that favoured single sex school girls (Table 5.6). In the same vein, statistical results from learners' perceptions based on the questionnaire instrument (chi-square = 10.398, df = 1, $p < 0.05$) showed significant difference in favour of single sex school girls (Figure 5.24). In light of these findings it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls' and mixed sex school boys' performance in science and technology subjects at school is thus rejected. One important observation to consider for this finding is the absence of competition by gender at a single sex school. This tends to give girls an advantage over boys with regards to performance in science and technology subjects.

6.2.4 Gender and Access to Subjects Offered by Schools

Although no statistical tests were done, it is imperative for me to talk about the subjects which are within this study's scope but were not offered by the two schools. The study revealed that, out of nine (Table 5.1, 5.3 & 6.1) science and technology related subjects which fall within this study's scope, the single sex school offered five while the mixed sex school offered eight. This means that the single sex school was denying the girl child an opportunity to access or study four technology related subjects. These were Metal Work, Wood Work, Building and Technical Graphics. On the other hand, the mixed sex school which offered eight subjects was denying both boys and girls an opportunity to access metalwork which it did not offer. Comparatively, a single sex school was worse in terms of denying the girl child access to technology subjects than a mixed sex school because it offered five subjects out of nine compared to eight offered at the mixed sex school (Tables 5.1-5.3). In light of this, it can be concluded that, schools channel subjects on gender lines because the girl child is disadvantaged in terms of access to science and technology subjects. Females have been singled out because the study is based on the view that women have been disadvantaged in terms of access to and performance in science and technology subjects. In fact, women have been perceived to be under-represented and under-achieving in those subjects which have traditionally been regarded as male defined (Miroux, 2011:7). The aim is not to disadvantage males, but to uplift women so that they can be at par with men in terms of access and performance in the subjects. Thus, the gender sensitivity in this study is aimed at informing the past and present imbalances with regards to boys' and girls' access to and their performance in science and technology subjects.

By inference, the presence of more technology related subjects in a mixed sex school (Table 6.1) was meant to cater for boys since the subjects were traditionally regarded as male inclined and more were offered to boys than girls. It is against this background that the school setting can be regarded as gender insensitive because it denies girls, especially those at a single sex and to a lesser extent, those from a mixed sex school of opportunities to pursue the above-named technology subjects.

Denying learners opportunities to study certain technology related subjects at school is against the Convention on the Rights of the Child (CRC). The CRC (1989), Article 28, obligates state parties to encourage the development of different forms of education including general and vocational education and make them available and accessible to every child, both girls and boys (Arnot & Pennel, 2008:7; UNESCO, 2012b:19).

This finding concurs with the symbolic interactionism's proposition that the patriarchal nature of the school culture is reflected through boys' and girls' differential access to science and technology subjects (Kangethe et al, 2014:281). Thus, teachers, who are products of gender role socialisation from the family, tend to create an uneven playing field in terms of boys' and girls' access to science and technology subjects (Molla, 2016:3). Consequently, boys are influenced to pursue science and technology subjects at school and girls to choose subjects which are considered as more suitable for females such as food and nutrition, fashion and fabrics and the arts.

6.2.5 Summary of the Quantitative Findings

I have deemed it necessary to give a summary of quantitative results. It helps to give a clear picture of the quantitative findings at a glance. Table 6.1 below presents a summary of quantitative results.

Table 6.1: Summary of Quantitative Results

	Comparable Science and Technology Subjects ('O' & 'A' Level)	**Significant Difference is in Favour of**	**Subjects Offered**	**Enrolment is in Favour of (Access in Terms of Numbers)**
Single sex girls & mixed sex girls	Mathematics, Physics, chemistry, Integrated Science and Agriculture,	**Access:** Single sex school girls **Perf:** Single sex school girls	**Single sex sch** Mathematics, Physics, chemistry, Integrated Science and Agriculture,	Single sex school girls
Boys and girls in a mixed sex school	Mathematics, Physics, chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building	**Access:** Mixed sex school boys **Perf:** The same/at par	**Mixed sex sch** Mathematics, Physics, chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building	Mixed sex school boys
Mixed sex boys & single sex girls	Mathematics, Physics, chemistry, Integrated Science and Agriculture	**Access:** Single sex school girls **Perf:** Single sex school girls		Single sex school girls

Key: Sch =school, Perf = Performance, 'O' Level = Ordinary Level, 'A' Level = Advanced Level

6.3 MAIN FINDINGS FROM QUALITATIVE DATA

In this section, the research findings are discussed as informed by the themes which were drawn from research questions that guided the study. The discussion focuses on the findings generated from the qualitative data obtained through face-to-face individual interviews with teachers at the two study sites. The qualitative objective of the study sought to explore factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

The interviews were conducted with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers. The discussion of the findings was done in order to establish the link of the study with current studies and new dimensions pertaining to boys' and girls' access to and their performance in science and technology subjects. Qualitative findings of the study are discussed in accordance with the themes discussed in the previous chapter. These are, factors influencing access to science and technology along gender lines, factors influencing school performance in science and technology along gender lines and the school as a gender socialising agent of masculinity and femininity through science and technology.

6.3.1 Qualitative Objective: To Explore Factors that could Influence Access to and Performance of Boys and Girls in Science and Technology Subjects at Single Sex and Mixed Sex Schools

This section presents and discusses the qualitative findings of the study under the following themes: factors influencing access to science and technology subjects along gender lines, factors influencing school performance in science and technology along gender lines and the school as a gender socialising agent of masculinity and femininity in science and technology.

6.3.1.1 Factors influencing access to science and technology subjects along gender lines

The study sought to uncover factors influencing access to science and technology subjects along gender lines at school. Various factors emerged from interviews conducted with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers.

6.3.1.1.1 The home has an ideology which is gender biased in favour of men

It emerged from the study that the home has an ideology which is gender biased in favour of men. Teachers pointed out that the types of toys they are exposed to at an early age and division of labour such as tough tasks for boys and light tasks for girls reinforce a gendered belief that boys are more powerful and superior than girls.

This is reflected in a quotation by one of the teachers who said that:

> *At home, boys are given tough toys while soft toys are for girls. This tends to have a bearing on learners' choice of subjects at school. Boys tend to pursue hard sciences while girls opt for arts and domestic sciences subjects [STM8].*

Another teacher at a single sex school indicated that,

> *Boys are assigned tough tasks such as metal work, wood work and building while girls sweep, cook and sew torn clothes. This influences boys to pursue science and technology subjects at school and girls to choose domestic sciences and arts subjects [STS1].*

The common idea from teachers was that a gender stereotyped home environment helped to track boys into science and technology subjects while girls were channelled to study commercials, arts and domestic science subjects such as food and nutrition as well as fashion and fabrics. Consequently, boys' and girls' differential choice of subjects at school could be have been socially constructed during interaction at home. The theoretical framework employed in this study corroborates the view that learners' differential choice of subjects are socially constructed during interaction at home because the way children are exposed to a gendered social world influences the development of their self-concepts and their subject choices (Carter & Fuller, 2015:7). Thus, through socialisation, there is internalisation of female values by girls which tends to limit their access to subjects viewed and labelled as 'masculine' (Runhare, 2003:134).

6.3.1.1.2 Schools channel science and technology subjects in favour of boys

The study revealed that teachers help to track boys into science and technology subjects and relegate girls to commercials, arts and domestic science subjects. Teachers indicated that they pass positive comments to boys doing science and technology subjects but do the opposite to girls pursuing the same subjects.

They felt that such attitudes do not put boys and girls at equal footing in terms of choice of subjects at school. They also noted that with boosted self-esteem, boys tend to prefer science and technology subjects while girls tend to settle for domestic science subjects, commercials and the arts. One of the teachers at a mixed sex school highlighted that:

> *Some teachers laugh at boys doing arts subjects. They make comments during interaction persuading the boy child to pursue science and technology subjects. They openly tell learners that sciences are for boys not girls [CTM1].*

Another teacher at a mixed sex school weighed in and saying:

> *Negative comments towards girls studying science and technology subjects make them aware that they are unequal to boys and that tends to lower their confidence to pursue science and technology subjects [STM3].*

Thus, respondents concurred that, teachers' attitudes and expectations play a role in boys' and girls' differential access to science and technology subjects at school. It can be concluded that schools have no choice but to follow in the footsteps of the home environment which reinforces the gendered belief that boys are more powerful and superior than girls. Ultimately teachers, who are products of a gendered society tend to perpetuate a gendered ideology through socialisation which limits girls' access to science and technology subjects. The findings above are supported by

Molla (2016:1) who asserts that the gender discrimination which exists at school favours boys to the detriment of girls who are often denied access to certain subject areas.

6.3.1.1.3 Socialising agents influence subject channelling on gender lines

It emerged from the interviews that socialising agents influence girls to pursue domestic science subjects and boys to study science and technology subjects. Teachers revealed that, by portraying men engaging in outdoor activities while women are shown as more of caregivers, the media would have instilled the belief that boys are more powerful and suitable to pursue science and technology subjects than girls.

This is reflected in a statement by one of the teachers who indicated that:

> *The media instil a belief that boys are more powerful and suitable to pursue science and technology subjects by portraying men engaging in outdoor activities while women are shown as more of caregivers in the home. Again, some learners, especially girls discourage other female friends from studying science and technology subjects which they perceive to be more difficult than domestic science subjects and the arts [STS4].*

Teachers also had a common perception that parents put pressure on their male children to pursue science and technology subjects because they view them as more capable than girls. One of the class teachers at a mixed sex school stated:

> *Parents choose subjects for their children. Due to gender role socialisation, they perceive boys as more capable than girls and encourage them to pursue science subjects and technology subjects [CTM9].*

The finding from the current study concurs with the symbolic interactionism theory on its proposition that the socialisation of strong traditional male superiority and female inferiority values has curtailed women’s opportunities to participate fully in the private and public spheres of life (Zinyemba, 2013:17). Thus, the gendered belief that boys are more powerful and suitable to pursue science and technology subjects than girls tends to curtail girls’ access to the subjects.

6.3.1.1.4 Learners' desire to easily secure well-paying and prestigious jobs

The study demonstrated that learners' desire to easily secure well-paying and prestigious jobs is another factor influencing access to science and technology subjects. Teachers observed that learners are more concerned about job opportunities, good salaries and status in society. One of the HODs revealed that:

> *Jobs associated with science and technology subjects are prestigious and offer good salaries. More people are drifting towards pursuing the subjects because of that [HODS2].*

The views of the respondents illustrate that learners' aspirations for better living standards provide an impetus for both boys and girls to choose science and technology subjects at school. Therefore, the gender factor is out. If the gender factor cannot be considered, it means learners' access to science and technology subjects should be equal. In line with this study's contention, more access for women is commendable because they have been disadvantaged in terms of access to science and technology subjects (Sanders, 2005:3). Therefore, it is fundamental to enhance access by females and not to disadvantage males in terms of their representation in science and technology subjects. Thus, the gender sensitivity in this study is aimed at informing the past and present imbalances with regards to boys' and girls' access to and their performance in science and technology subjects. More access for single sex school girls than mixed sex school boys in science and technology subjects might have been driven by their desire to get good jobs which offer better salaries later in life. In harmony with the above findings, the American Institute for Research (AIR) (2015:ii) notes that science and technology subjects offer good opportunities for post-secondary prestigious careers.

6.3.1.2 Factors influencing school performance in science and technology along gender lines

Interviews conducted with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers yielded some insightful data in relation to factors that influence school performance in science and technology along gender lines. These are explored in this section.

6.3.1.2.1 Patriarchal influence on differential performance in science and technology subjects by gender

It arose during the interviews that patriarchal practices in the family create an uneven playing field in terms boys' and girls' performance in science and technology subjects. This was revealed by one of the interviewed teachers who indicated that:

> *The family is an agent for gender role socialisation that instils the superiority mentality in boys by assigning them tough tasks such as building and the inferiority mentality in girls by giving them light tasks like sewing and sweeping. Consequently, boys build confidence and tend to perform better* in *science and technology subjects than girls [CTM7].*

These findings depict that, parents play a role in boys' and girls' differential performance in science and technology subjects at school. In fact, they have an ideology which is gender biased in favour of boys. This position supports earlier findings by Marinova (2003:3) who established that the home environment affects girls' performance in science and technology related subjects by socialising them to believe that boys are superior to them.

6.3.1.2.2 Teachers' expectations and self-fulfilment on differential school performance in science and technology by gender

Respondents affirmed that teachers expect boys to perform better than girls in science and technology subjects at school. Teachers shared the general perception that:

> *Through comments to girls like, 'You cannot be as good as boys in science and technology subjects', teachers expect boys to perform better in science and technology subjects than girls [STM5].*

Another teacher highlighted that:

> *Sometimes teachers pass comments like, 'I told you that science subjects are for boys because they are difficult.' As a result, boys tend to gather confidence resulting in them performing better than girls [CTS7].*

These sentiments imply that teachers expect boys to perform better than girls. Teachers felt that there is gender role socialisation which fostered male superiority over females. This observation correlates with findings from a study by the European Commission (2009:73) which concluded that, women's achievement in male defined subjects such as science and technology is low.

This finding is consistent with the symbolic interactionism's proposition that the interaction between learners and teachers who are the significant others makes the school the most powerful socialising force that fosters and support societal stereotypes for gender behaviour (Masanja, 2010:1; Ritzer, 2004:56). In this regard, learners' exposure to a gendered school environment tends to favour boys than girls in terms of performance in science and technology subjects.

6.3.1.2.3 Patriarchal ideologies embedded in society result in boys performing better than girls

The study established that patriarchal ideologies embedded in society result in boys performing better than girls. Teachers believed that there are patriarchal ideologies embedded in society in the form of provision of different toys for boys and girls at home, media bias in favour of boys and negative peer influence. One of the teachers stated that:

> *Teachers pass positive comments to boys pursuing science and technology subjects and doing the opposite to girls studying the same subjects. Comments such as, 'You have performed like a real boy' portray boys as more capable in science and technology subjects than girls [STM6].*

Another teacher felt that:

> *The provision of different toys for boys and girls at home tends to translate into differential performance in science and technology subjects at school as boys tend to have more confidence in tackling science and technology subjects than girls. The media and friends sometimes portray boys as superior and more capable in sciences than girls [STM4].*

The portrayal of women as inferior tends to result in their performance in science and technology subjects being curtailed. Thus, through teachers' comments, children's exposure to different toys at home, media bias in favour of boys and negative peer influence, individuals internalise male and female social values resulting in differential performance in science and technology subjects at school. In the same vein, Miroux (2011:7) observed that girls were under-achieving in perceived male dominated subjects.

6.3.1.2.4 Influence of gender on career choices and school performance in science and technology

It emerged from the study that, learners' performance in science and technology subjects is enhanced by their desire for easy passage to careers with good salaries. Teachers' perceptions were that learners know that they won't struggle to get vacancies at higher learning institutions and also in securing employment later in life. One of the teachers emphasised that:

> *Learners know that careers associated with science and technology related subjects offer both prestige and good salaries. They are aware that they have to work hard in order to achieve [CTM2].*

Teachers concurred that learners desire careers associated with science and technology related subjects which offer lucrative salaries. Therefore, learners see the need to take an active role and work hard if they are to produce any meaningful outcomes in science and technology subjects. This implies that learners' zest to achieve rather than gender is a catalyst to the effort which they exert. These results tend to mirror a scenario in which girls are at par or even perform better than boys. Such results contradict Gilbreath's (2015:3) research findings which revealed that men are 'smarter' than women with regards to performance in science and technology subjects.

6.3.1.3 The school as a gender socialising agent of masculinity and femininity through science and technology

This section discusses factors that emerged from Interviews conducted with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers with regards to schools' subject channelling on gender lines. Specifically, the findings are about the school as a gender socialising agent of masculinity and femininity through science and technology.

6.3.1.3.1 Teachers' gender 'typification' and stereotyping of science and technology subjects

It emerged that teachers view science and technology subjects as best suited for boys than girls. Respondents were unanimous that subject channelling tends to take place in a subtle way or via the hidden curriculum at school. Although they claimed to be gender neutral, they did not deny that teachers are agents of differential access in science and technology subjects at school. A teacher at a mixed sex school remarked that:

> *Teachers channel subjects on gender lines in a subtle way. We encourage boys not only to pursue science and technology subjects at school, but also to perform better in the subjects. We do it unintentionally because we are products of the gender role socialisation in the societies we live [STM7].*

Similar sentiments were expressed by another teacher at a mixed sex school who revealed that:

> *During teacher-learner interaction at school, teachers reproduce male domination without realising it. As we interact with learners at school, we give the impression that girls are not at par with boys in terms of performance in science and technology subjects. That happens in a subtle way [CTM4].*

Thus, teachers concurred that comments which they pass during teacher-learner interaction give an impression that girls are not at par with boys in terms of performance in science and technology subjects. In view of the above, teachers, as products of the gender role socialisation in society admitted that they are also biased in favour of boys in terms of access to and performance in science and technology related subjects. The above findings resonate with those by Azimpour and Khalilzade (2015:20) who concluded that the hidden curriculum disseminates expectations and messages which expose children to the acquisition of appropriate social values resulting in differential access and achievement of boys and girls in science subjects.

6.3.1.3.2 School gender bias in science and technology curriculum offering

The study revealed that schools do not give boys and girls equal chances (in terms of subjects offered) to study science and technology subjects. This emerged during interviews with teachers who pointed out that learners at some single sex schools are denied access to subjects such as Technical Graphics, Wood Work, Metal Work and Building. A class teacher at a mixed sex school explained thus:

> *Our school is better because it is a mixed sex institution. A single sex school where my daughter is attending does not offer Building, Wood Work, Metal Work and Technical Graphics. This shows that schools are denying girls an opportunity to pursue these subjects [CTM8].*

Another teacher at a mixed sex school remarked that:

> *Some mixed sex schools like ours do not offer certain subjects like Metal Work thereby denying both girls and boys an opportunity to pursue the subject CTM7].*

By not offering certain science and technology subjects, schools can be regarded as agents for gender inequality as they limit girls' access to subjects traditionally labelled as 'masculine' such as those identified by interviewed participants. Girls have been singled out because the study is based on the view that women have been perceived to be under-represented and under-achieving in those subjects which have traditionally been regarded as male defined (Maria, 2015:12). Therefore, the aim is not to disadvantage males, but to uplift women so that they can be at par with men in terms of access and performance in science and technology subjects. Thus, the gender sensitivity in this study is aimed at raising awareness about the importance of creating a level playing field in terms of access to and performance in science and technology subjects. With regards to differential access as a result of not offering other subjects at school, Kangethe et al, (2014:288) point out that, schools tend to categorise academic subjects as either masculine or feminine, a practice known as gender typing. This implies that what is learnt at school depends on the ideologies about gender that are embedded in the private and public spheres of life. Thus, gender bias by teachers can be a result of gender socialisation which takes place at home and infiltrates into other social institutions like the school among others.

6.3.1.3.3 Adequate gender equity in career counselling

The study established that schools treat learners equally when giving career counselling. According to the teachers, schools do not treat learners differently when giving career counselling. Teachers were unanimous that they are gender sensitive when giving career advice to learners at school. One of the interviewed HODs admitted that:

> *We don't treat them differently. We tell them that anybody can do any job regardless of gender [HODM1].*

A class teacher at the same school echoed similar sentiments. He said:

> *We treat them equally when giving career advice. We believe that any person can perform any job irrespective of gender [CTM2].*

With regards to the aspect of giving career advice to boys and girls, schools have been found to be gender sensitive. A study by Zvobgo (2004:70) which found women to be under-achieving in science and technology related subjects contradict the above findings.

This finding does not correlate with the symbolic interactionism's theory which posits that the school environment influences boys to fulfil the superiority label and girls to fulfil the inferiority label as teachers were found to be gender sensitive when giving career counselling (Mutekwe & Mutekwe, 2012:196). In this regard, teachers create an even playing field in terms of boys' and girls' access to and their performance in science and technology subjects.

6.3.1.3.4 Schools differentiate responsibilities on gender lines

The study demonstrated that schools assign tough tasks to boys and light tasks to girls. It emerged during interviews with teachers that schools differentiate responsibilities for boys and girls by assigning tough tasks such as the lifting or arranging of heavy furniture to boys and light duties like sweeping or picking up papers to girls. A mixed sex school teacher revealed that:

> *Light tasks like picking up papers in the classroom are done by girls while tough tasks like movement of heavy furniture are carried out by boys [STM7].*

Assigning tasks along gender lines portrays boys as more powerful than girls, thereby entrenching the inferiority mentality in girls which tends to affect not only their choice of subjects but also their performance in science and technology. These findings resonate with studies by Hamieh and Usta (2011:3) who observe that the gender role socialisation which epitomises male supremacy by perceiving an ideal man as the provider, strong, powerful and the sole decision-maker who sometimes punishes his family members if they make mistakes is to blame for learners' differential treatment at school. Thus, the gendered school environment tends to affect girls' access to and their performance in science and technology subjects.

6.3.1.3.5 School gender bias in science and technology performance

It emerged during interviews with participants that, the performance of boys and girls in science and technology subjects is at par. The general picture among teachers was that there is absolutely no sex that performs better than the other. One of the teachers indicated that:

> *Recent years have witnessed similar performance of boys and girls at both 'O' and 'A' Levels [CTM8].*

Another teacher at the same school also revealed that:

> *It is sometimes a see-saw but basically the performance of boys and girls in science and technology subjects at schools is at par [STM6].*

Contrary to the above findings, Parry (2012:1) found out that teachers tend to rate girls' mathematical abilities lower than those of male students.

6.4 TRIANGULATION OF QUANTITATIVE AND QUALITATIVE FINDINGS

This section merges quantitative and qualitative findings discussed in this chapter. Quantitative findings were gathered through questionnaire schedules administered to mixed sex and single sex school learners as well as school documents namely, ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results. Qualitative data were gathered through individual face to face interviews with heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers as well as science and technology subject teachers. Findings from school documents namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results form the basis for this triangulation because they provided actual access and performance results of study participants.

These findings which have already been merged with learners’ perceptions on the influence of parents, the school, media and peers on boys’ and girls’ access and performance in science and technology subjects are compared and contrasted with qualitative findings. Triangulation is undertaken under the three quantitative objectives.

6.4.1 Quantitative Objective 1: To Establish if there is any Significant Difference in Access to and Performance of Girls in Science and Technology Subjects at Single Sex and Mixed Sex Schools

In terms of this objective, quantitative findings on access and performance compared girls in a single sex school and their counterparts in a mixed sex school. The comparison yielded findings to be triangulated with qualitative findings.

6.4.1.1 Access to science and technology subjects for single sex and mixed sex school girls

Since this study was predominantly on access and performance by gender, there are very little qualitative findings based on the type of school, that is, comparing girls at a single sex and a mixed sex school. The only aspect which the quantitative and qualitative strands corroborate each other is on access based on subjects offered at a single sex and a mixed sex school. Quantitative findings on subjects offered established that mixed sex school girls offered more subjects and therefore, had more access than single sex school girls (Tables 5.1-5.3. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building as compared to Mathematics, Physics, Chemistry, Integrated Science and Agriculture taught at a single sex school (Tables 5.1-5.3).

This observation is supported by more single sex school girls 74/81(91%)-7/81(9%) than their mixed sex school counterparts 47/59(80%)-12/59(20%) whose perceptions were that there were science and technology subjects they wanted to study but were not taught at their school (Figure 5.11). Similar findings also emerged from interviewed teachers who were of the view that learners at some single sex schools are denied access to certain science and technology subjects that form the scope of this study. A mixed sex school teacher posited that:

> *Our school is better because it is a mixed sex institution. A single sex school where my daughter is attending does not offer Building, Wood Work, Metal Work and Technical Graphics. This shows that schools are denying girls an opportunity to pursue these subjects [CTM8].*

This was supported by another teacher at the same school who said:

> *Some single sex schools like our neighbour do not offer all those subjects like Metal Work, Building and Wood Work. It offers only Agriculture because it is a single sex school CTM7].*

This implies that mixed sex and single sex school girls' access to science and technology subjects (in terms of subjects offered) is influenced by the type of school that they attend.

By inference, the presence of more technology related subjects in a mixed sex school (Table 6.1) was meant to cater for boys since the subjects were traditionally regarded as male inclined and more were offered to boys than girls. Therefore, learning in a mixed sex school gave an advantage to mixed sex school girls than single sex school girls in terms of access to the number of subjects offered by the school. Channelling subjects on gender lines is against Goal 3 of the Millennium Development Goals (MDGs) signed in September 2000 which commits member countries to promote gender equality and empower women and eliminate gender disparity at all levels of education.

6.4.1.2 Single sex and mixed sex school girls' performance in science and technology subjects

With regards to performance, statistical findings from school documents namely, ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, (Table

5.4) depicted significant difference ($p<0.05$) in favour of single sex school female learners. The null hypothesis which claimed that there was no significant difference in terms of single sex and mixed sex school girls' performance in science and technology subjects at school was therefore rejected. Due to gender competition, mixed sex school girls tend to be overshadowed by boys in terms of performance in science and technology subjects. This gives an advantage to single sex school girls who compete among themselves to perform better than mixed sex school girls in the subjects. There are no qualitative findings to corroborate this quantitative finding.

6.4.2 Quantitative Objective 2: To Find out if there is any Significant Difference in Access to and Performance in Science and Technology Subjects for Boys and Girls in Mixed Sex Schools

This objective compared access and performance in science and technology subjects for boys and girls in a mixed sex school. Quantitative and qualitative findings are triangulated in this section.

6.4.2.1 Mixed sex school boys' and girls' access to science and technology subjects

Results from both the quantitative and qualitative strands point towards a similar position on access to science and technology subjects for boys and girls learning together in a mixed sex school. The findings are based on statistical calculations as well as access in terms of numbers (Table 5.2).

Statistical findings with regards to mixed sex school boys' and girls' access to science and technology subjects from ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Table 5.2) depicted significant difference ($p<0.05$) in favour of boys. Similar findings emerged from mixed sex school boys' and girls' perceptions from the questionnaire instrument (Figure 5.20) whose statistical results (chi-squared value = 27.77, df = 1, $p< 0.05$) revealed significant difference in favour of boys. Overall, the significant difference in terms of access is in favour of boys. In view of this, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected.

In terms of enrolment figures, boys were more than girls in ‘O’ Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in Mathematics (198/221) and Integrated Science (205/220) subjects only. In all comparable ‘A’ Level subjects namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects compared to girls. An observation to consider with regards to these findings is the gender competition for access at a mixed sex school which tends to disadvantage girls as compared to boys.

There is a correlation between the quantitative results above and findings from interviews with teachers on mixed sex school boys’ and girls’ access to science and technology subjects. Teachers revealed that the home environment has an ideology which is gender biased in favour of men and which helps to track more boys than girls into science and technology subjects. One of the teachers at a mixed sex school was quoted saying:

> *At home, boys are given tough toys while soft toys are for girls. This tends to influence more boys than girls to pursue* science and technology subjects *at school [STM7].*

Similar sentiments were raised by another teacher at a single sex school thus:

> *Assigning tough tasks such as metal work, wood work and building at home gives boys confidence to study science and technology subjects. On the other hand, girls who are assigned light tasks like sweeping and sewing tend to pursue domestic sciences and arts subjects [STS1].*

The implication is that a gender stereotyped home environment helps to channel more boys than girls into science and technology subjects. In this regard, the quantitative and qualitative findings corroborate each other.

The quantitative and qualitative findings also corroborate each other as evidenced by teachers who affirmed that schools channel science and technology subjects in favour of boys. Respondents revealed that teachers help to track more boys than girls into science and technology subjects. One of the teachers stated that:

> *… teachers castigate boys doing domestic sciences and arts subjects and say nothing to girls. Boys are openly persuaded to study science and technology subjects while girls are encouraged to pursue domestic sciences and arts subjects. Teachers also encourage boys to choose science and technology subjects by assigning them tough tasks like furniture movement while light tasks are done by girls [STM7].*

Another teacher added that:

> *Positive comments towards boys boost their confidents resulting in more boys than girls studying science and technology subjects at school. Teachers are always positive towards boys studying science and technology subjects than girls because they are products of the gender role socialisation in the societies they live [STM3].*

Thus, teachers' attitudes and expectations at school result in more boys than girls pursuing science and technology subjects.

Quantitative results (Table 5.2) which depicted significant difference ($p<0.05$) in favour of boys with regards to mixed sex school boys' and girls' access to science and technology subjects are also corroborated by interview findings which affirmed that socialising agents influence subject channelling on gender lines. This was corroborated by respondents in the interviews, one of whom commented that:

> *The print and electronic media instil a belief that boys are more powerful and suitable to pursue science and technology subjects by portraying men engaging in outdoor activities while women are shown as more of caregivers in the home. Again, peers, especially girls discourage other female friends from studying science and technology subjects which they perceive to be more difficult than domestic science subjects and the arts [STS4].*

Another respondent singled out parents and teachers who put pressure on their male children to pursue science and technology subjects because they view them as more capable than girls. A mixed sex school class teacher highlighted that:

Parents choose subjects for their children. Due to gender role socialisation, they perceive boys as more capable than girls and encourage them to pursue science and technology subjects. Teachers also laugh at boys doing arts subjects and are proud of those studying science and technology subjects [CTM9].

The quotations illustrate that socialising agents influence more boys than girls to pursue choose science and technology subjects at school.

On subjects offered (Tables 5.1-5.3), the study revealed that both mixed sex school boys and girls had access to all subjects which formed the scope of this study, except building. These are: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building. There is a point of departure between quantitative and qualitative findings in that teachers compared access between single sex and mixed sex school girls rather that boys and girls learning together. Teachers pointed out that learners at some single sex schools are denied access to subjects such as Technical Graphics, Wood Work, Metal Work and Building. Thus, qualitative findings did not compare boys and girls learning together at the mixed sex school.

A class teacher at a mixed sex school elaborated thus:

Some single sex schools like our neighbour do not offer Building, Wood Work, Metal Work and Technical Graphics. This shows that schools are denying girls an opportunity to pursue these subjects you are talking about [CTM8].

This shows lack of correlation between quantitative results and qualitative findings from interviews. Interviewed respondents only mentioned access between single sex and mixed sex school girls instead of boys and girls learning together at a mixed sex school.

6.4.2.2 Performance in science and technology subjects for mixed sex school boys and girls

Statistical findings from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results on performance between boys and girls learning together in a mixed sex school, revealed no significant difference ($p>0.05$). There is a correlation between these quantitative results and qualitative findings from interviews with teachers. Respondents proffered that nowadays boys and girls pursue science and technology subjects so that they can have easy passage to good jobs with lucrative salaries. One of the teachers highlighted that:

> *Learners study science and technology subjects because of the lucrative salaries which they offer [CTM3].*

This implies that the influence of the job market tends to be the driving force towards the similar performance evident between mixed sex school boys and girls in science and technology subjects. Therefore, the qualitative findings dovetail with the actual performance of learners. It is important to point out that these findings may be a result of increased efforts by the AU Conference of African Women in Science and Technology 2007 which called upon governments to support the full participation of girls and women in science and technology related fields (SARDC, 2016:39).

Results from both the quantitative and qualitative strands also corroborate each other as affirmed by interviewed teachers who said that recent years had witnessed similar performance of boys and girls in science and technology subjects. Evidence to support this assertion was presented by a mixed sex school teacher whose perception was that:

> *Performance between boys and girls in science and technology subjects is at par. Recent years have witnessed similar performance of boys and girls at both 'O' and 'A' Levels [CTM6].*

The excerpts above depict the correlation between quantitative and qualitative findings of the study.

These findings contradict this study's theoretical framework which emphasises that individuals develop a self-concept or a picture of themselves which has an important influence on their resultant actions such as choice of subjects and performance at school (Gay, 2000:2 & Rousseau, 2002:1). According to the symbolic interactionism theory, it is from the interaction processes with others most notably those that learners' esteem highly that result in differential access and performance in science and technology subjects (Ritzer, 2004:56). In this regard, boys' and girls' exposure to the gendered social world at school did not influence their performance in science and technology subjects at school. In fact, their performance was at par.

6.4.3 Quantitative Objective 3: To Establish if there is any Significant Difference in Access to and Performance in Science and Technology Subjects between Girls at a Single Sex and Boys at a Mixed Sex School

With regards to this objective, quantitative findings on access and performance compared girls in a single sex school and boys in a mixed sex school. The comparison yielded findings to be triangulated with qualitative findings.

6.4.3.1 Access to science and technology subjects between girls at a single sex and boys at a mixed sex school.

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results, established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys. Similarly, statistical tests (chi-squared value = 10.46, df = 1, $p < 0.05$) from mixed sex school boys' and single sex school girls' perceptions based on the questionnaire instrument (Figure 5.21) revealed significant difference which was in favour of girls. Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: 'O' Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93).

With regards to access in terms of statistical findings as well as numbers, quantitative and qualitative strands depict points of departure. Interviewed teachers' findings revealed lack of correlation with quantitative findings above. While quantitative findings (Table 5.3) indicated significant difference in favour of girls, one of the interviewed teachers asserted that:

> *At school, boys are assigned to carry out heavy tasks such as furniture movement while girls are given light tasks like picking up papers. Socialising agents like peers, parents and the media also portray boys as more powerful than girls. As a result, we tend to have more boys than girls opting to study science and technology subjects at school [STM5].*

These findings do not concur with quantitative results.

On subjects offered, it emerged from quantitative findings that mixed sex school boys had more subjects offered at their school and therefore, had more access than single sex school girls (Tables 5.1- 5.3). The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building while the single sex school taught Mathematics, Physics, Chemistry, Integrated Science and Agriculture. This finding is corroborated by the perceptions of the majority of single sex school girls 74/81(91%)-7/81(9%) compared to mixed sex school boys 16/53(30%)-37/53(70%) (Figure 5.11) who felt that there were science and technology subjects they wanted to study but were not offered at their school. Similar findings were confirmed during individual interviews with teachers who indicated that learners at some single sex schools are denied access to certain science and technology subjects that form the scope of this study. This was illustrated in the following quotation from a single sex school teacher:

> *…we do not offer Building, Wood Work, Metalwork and Technical Graphics. It means our girls who wanted to pursue some of these subjects are denied the opportunity [STS1].*

Another teacher from the same school weighed in thus:

> *I have a sister at this school who has a passion for woodwork, but the subject is not part of our curriculum. We will make a suggestion in our meetings so that the school considers increasing technical subjects to the ones we currently have [CTS2].*

This implies that mixed sex school boys' and single sex school girls' access to science and technology subjects (in terms of subjects offered) is influenced by both gender and the type of school. In view of these findings, the school setting, can to a certain extent, be regarded as gender insensitive because it channels science and technology subjects which were traditionally regarded as male inclined and offered more to boys than girls along gender lines. By inference, the presence of more technology related subjects in a mixed sex school (Table 5.3) was meant to cater for boys since the subjects were traditionally labelled suitable for males' and more were offered to boys than girls. Promoting access to science and technology subjects along gender lines is against the Convention on the Elimination of Discrimination in Education (CEDE) (1960) which commits state parties to formulate, develop and apply a national policy which will promote equality of opportunities and treatment in the matter of education without discrimination based on sex, age, ethnicity, language, location and income level (UNESCO, 2012b:19).

6.4.3.2 Performance of girls in a single sex and boys in a mixed sex school in science and technology subjects

Performance results from single sex school girls and mixed sex school boys using school documents, namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results depicted significant difference that favoured single sex school girls (Table 5.6). In the same vein, statistical results from learners' perceptions based on the questionnaire instrument (chi-square = 10.398, df = 1, $p < 0.05$) showed significant difference in favour of single sex school girls (Figure 5.24).

In light of these findings from the two data sets, it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls' and mixed sex school boys' performance in science and technology subjects at school is thus rejected. The reason for this finding may be competition by gender that boys at the mixed sex school are exposed to. Consequently, single sex school female learners who compete among themselves tend to have an advantage over mixed sex school boys in terms of performance in science and technology subjects. There are no qualitative findings to corroborate these quantitative findings.

Quantitative and qualitative findings on performance between girls in a single sex school and boys in a mixed sex school indicate that they are not correlated. Results from interviews with teachers established lack of concurrence with quantitative findings. During an interview one of the teachers commended that:

> *The provision of different toys for boys and girls at home tends to translate into differential performance in science and technology subjects as boys tend to have more confidence in tackling the subjects than girls. Even division of labour on gender lines by teachers such as giving tough tasks to boys than girls boosts boys' confidence in terms of performance. The media and friends sometimes portray boys as superior and more capable in sciences than girls [STM4]*

Findings from the two strands depict points of departure.

6.5 CHAPTER SUMMARY

This chapter has presented a summary of the study findings based on quantitative data gathered through questionnaire guides and school documents namely: the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results. The chapter also presented a summary of the study findings based on qualitative data gathered through interviews. The main aim of this study was to examine how gender socialisation affects boys' and girls' access to and their performance in science and technology subjects. The study sought to determine and explore the nature of boys' and girls' access to and their performance in science and technology subjects at a single sex and a mixed sex school in Zimbabwe.

The study was a mixed method study with a convergent parallel design. It was underpinned by the pragmatic philosophical world view and was underpinned by the symbolic interactionism theory. The theory contends that the meanings that individuals come to perceive themselves in terms of their choice of subjects at school are socially constructed, developed and modified within interaction situations rather than being predetermined at birth. This study had two samples: one for the quantitative strand and the other for the qualitative strand. The probability stratified random sampling method was adopted for the quantitative sample size of 193 learners. It comprised of 112 learners from a mixed sex school. Of these, 53 were boys while 59 were girls. It also consisted of 81 girls from a single sex school. The qualitative sample size of 44 participants from the two study sites was purposively selected. The sample at a mixed sex school consisted of 1 head of school, 1 deputy head, 2 science and technology subjects HODs, 11 science and technology subjects class teachers and 8 science and technology subject teachers. The sample at the single sex school comprised of 1 head of school, 1 deputy head, 2 science and technology subject HODs, 10 science and technology subjects class teachers and 7 science and technology subject teachers.

Quantitative data analysis was done statistically using chi-square and binomial tests while qualitative data from interviews were analysed thematically and in purely descriptive form. Quantitative and qualitative results were presented separately before they were merged in order to compare, contrast and corroborate them from the two strands. The merged findings were then discussed by placing them in the broader context of existing related literature.

In terms of access to science and technology subjects between single sex and mixed sex school girls (Table 5.1), quantitative findings from school documents namely, the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results revealed significant difference ($p<0.05$) which favoured single sex school girls. The null hypothesis which claimed that there is no significant difference in terms of single sex and mixed sex school girls’ access to science and technology subjects at school was therefore rejected.

With regards to numbers, the single sex school girls had higher access to science and technology subjects in all ‘O’ and ‘A’ Level subjects (Table 5.1). This was evidenced by the following enrolment figures: ‘O’ Level Physics (93/40), Chemistry (97/43), Agriculture (86/22), Mathematics (253/221) and Integrated Science (242/220) as well as ‘A’ Level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). These findings dovetail with the majority of single sex school female learners’ perceptions 74/81(91%)-7/81(9%) who revealed that they have the desire to study science and technology subjects if they are given an opportunity (Figure 5.11). An observation to make from these results is that single sex school girls compete on their own for access to science and technology subjects while in mixed sex school girls compete with boys. This gives single sex school girls an advantage over their mixed sex school counterparts.

On performance between mixed sex and single sex school girls, statistical findings from school documents namely, the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results (Table 5.4), depicted significant difference ($p<0.05$) in favour of single sex school female learners. The null hypothesis which claimed that there was no significant difference in terms of single sex and mixed sex school girls’ performance in science and technology subjects at school was therefore rejected. The obvious reason for this is that in a single sex school, all learners are girls who compete among themselves while mixed sex school girls compete with boys. The presence of boys disadvantages girls, resulting in them performing worse than their single sex school counterparts.

With regards to boys and girls learning together at a mixed sex school, statistical findings on access to science and technology subjects from the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results depicted significant difference ($p<0.05$) in favour of boys (Table 5.2). Similar findings emerged from mixed sex school boys’ and girls’ perceptions from the questionnaire instrument (Figure 5.20) whose statistical results (chi-squared value = 27.77, df = 1, $p< 0.05$) revealed significant difference in favour of boys. Overall, the significant difference in terms of access is in favour of boys. In view of this, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected.

In terms of enrolment figures (Table 5.2), boys were more than girls in ‘O’ Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in Mathematics (198/221) and Integrated Science (205/220) subjects only. In all comparable ‘A’ level subjects namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects compared to girls.

Worth noting is the fact that the gender competition for access at a mixed sex school tends to disadvantage girls compared to boys. This finding shows that there is competition for access between boys and girls that gives an advantage to boys than girls.

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results on performance (Table 5.5) between boys and girls learning together in a mixed sex school, revealed no significant difference ($p>0.05$). This finding may be a result of increased efforts of the AU Conference of African Women in Science and Technology 2007 which called upon governments to support the full participation of girls and women in science and technology related fields (SARDC, 2016:39). The reason for this finding could be the efforts of the 1995 Beijing Platform for Education (BPFA), which called upon governments and all stakeholders to increase women's access to and performance in in science and technology (Debusscher, 2015:20; SARDC, 2016:38; UN, 2010:4). This culminated in the formulation of the 2004 national Gender Policy in Zimbabwe which advocated for gender parity in private and public spheres of life.

Statistical findings from the ZIMSEC 2016 – 2017, 'O' and 'A' level final national examinations results (Table 5.3) between mixed sex school boys and single sex school girls, established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls. Similarly, statistical tests (chi-squared value = 10.46, df = 1, $p < 0.05$) from mixed sex school boys' and single sex school girls' perceptions based on the questionnaire instrument (Figure 5.21) revealed significant difference which was in favour of girls. Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: 'O' level integrated science (205/242), mathematics (198/253), physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' level Mathematics (65/129), Physics (38/68) and Chemistry (37/93).

The possible reason for this finding is that in a single sex school, all learners are girls who compete for access on their own while in a mixed sex school, gender competition is a major factor. It is likely that the presence of girls in a mixed sex school disadvantages boys compared to single sex school girls in terms of access to science and technology subjects.

Performance results from single sex school girls and mixed sex school boys using school documents, namely: the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results showed significant difference that favoured single sex school girls (Table 5.6). In the same vein, statistical results from learners’ perceptions based on the questionnaire instrument (chi-square = 10.398, df = 1, $p < 0.05$) showed significant difference (Figure 5.24) in favour of single sex school girls. In light of these findings from the two data sets, it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls’ and mixed sex school boys’ performance in science and technology subjects at school is thus rejected. Worth noting is the absence of competition by gender at a single sex school. This tends to give girls an advantage over boys with regards to performance in science and technology subjects.

In terms of subjects offered, the study revealed that, out of nine (Table 5.1, 5.3 & 6.1) science and technology related subjects which fall within this study’s scope, the single sex school offered five while the mixed sex school offered eight. This implies that the single sex school was denying the girl child of an opportunity to access or study four technology related subjects. These were: metalwork, woodwork, building and technical graphics. The mixed sex school which offered eight subjects was denying girls an opportunity to access metalwork which it did not offer. Comparatively, the single sex school was worse in terms of denying the girl child access to technology subjects than the mixed sex school.

Girls only were mentioned as being denied access in this study because the study is premised on the view that women have been disadvantaged in terms of access to and performance in science and technology subjects. Therefore, the gender sensitivity in this study is not to disadvantage men but to correct the past and present imbalances so that women can be at par with men in terms of their access to and performance in science and technology subjects.

The main qualitative findings with regards to factors influencing access to science and technology subjects along gender lines revealed differential access in favour of boys. It emerged from the study that the home has an ideology which is gender biased in favour of men. One of the teachers illustrated that:

> *Assigning tough tasks such as metal work, wood work and building at home give boys confidence to study science and technology subjects. On the other hand, girls who are assigned light tasks like sweeping and sewing tend to pursue domestic sciences and arts subjects [STS1].*

The study also revealed that through positive comments for boys and negative comments for girls, teachers help to track boys into science and technology subjects and relegate girls to commercials, arts and domestic science subjects. One of the interviewed teachers remarked that:

> *Positive comments like, 'Real boys always pursue sciences' tend to boost their confidents resulting in more boys than girls studying science and technology subjects at school [STM3].*

The study revealed that socialising agents influence girls to pursue domestic science subjects and boys to study science and technology subjects at school. On a different note, the study demonstrated that learners' desire to easily secure well-paying and prestigious jobs is another factor which gave both sexes an impetus to access science and technology subjects.

Factors influencing school performance in science and technology subjects along gender lines were unearthed. The study found out that patriarchal practices in the family such as assigning tough tasks to boys and light tasks to girls help to build confidence in boys, resulting in them performing better than girls in science and technology subjects at school. The study established that patriarchal ideologies embedded within the school system result in boys performing better than girls in science and technology subjects. One teacher highlighted that:

> *Sometimes teachers pass comments like, 'Science subjects are for boys because they are difficult'. As a result, boys tend to gather confidence resulting in them performing better than girls [CTS7].*

On patriarchal ideologies peddled by socialising agents, teachers concurred that boys' and girls' differential treatment at home, teachers' comments at school, media bias in favour of boys and negative peer influence tend to limit girls' performance in the subjects. It also emerged from the study that learners pursue science and technology subjects so that they can have easy passage to careers with good salaries. One of the teachers pointed out that, *"Learners study science and technology subjects because of the lucrative salaries which they offer" [CTM3].*

Some factors were also explored with regards to the school as a gender socialising agent of masculinity and femininity through science and technology. The study found out that teachers view science and technology subjects as best suited for boys than girls. Teachers also revealed that schools do not give boys and girls equal chances (in terms of subjects offered) to study science and technology subjects. This was revealed by the mixed sex school that offered eight subjects compared to five offered by the single sex school. Again, it emerged from the study that schools treat learners equally when giving career counselling. Teachers were found to be gender sensitive on this aspect. The study further established that schools assign tough tasks to boys and light tasks to girls, thereby affecting their subject choices through portraying boys as superior. This was corroborated by teachers one of whom substantiated that:

> *Light tasks like picking up papers in the classroom are done by girls while tough tasks like movement of heavy furniture are carried out by boys [STM7].*

Findings from this study also showed that the performance of boys and girls in science and technology subjects is at par. On this aspect, teachers based their perceptions on their teaching experience in the respective science and technology subjects which they offer.

CHAPTER SEVEN

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 CHAPTER INTRODUCTION

The previous chapter presented a summary of the study findings based on quantitative data gathered through questionnaire guides and school documents namely: the ZIMSEC 2016 – 2017, 'O' and 'A' level final national examinations results. The chapter also presented a summary of study findings based on qualitative data gathered through interviews. It then merged quantitative and qualitative study findings to show concurrence and points of departure between them. This chapter concludes the study on gender sensitivity in the teaching and learning of science and technology subjects in Zimbabwean secondary schools. The chapter gives a summary of main findings guided by research objectives, theoretical framework, literature review and empirical findings. It also presents recommendations that are pertinent and useful not only to this study, but also to the important aspect of deconstructing gender biases against women which were constructed during socialisation in the home, school and community.

The study's aim was to examine the extent to which, and how gender socialisation affects the education of boys and girls in terms of access to, and performance in science and technology subjects. The exploration of the nature of access to and performance in science and technology subjects by boys and girls at mixed sex and single sex schools was central to this research. The study's quantitative inclined objectives were to establish if there was any significant difference in access to and performance in science and technology subjects between girls in single sex and those in mixed sex schools, boys and girls learning together at mixed sex schools as well as boys in mixed sex and girls in single sex school.

An objective that was meant to generate qualitative data sought to explore factors that could influence access to and performance of boys and girls in science and technology subjects at single sex and mixed sex schools. This chapter is divided into the following sub-headings: summary of major findings**,** limitations of the study, generation of new knowledge, conclusions, recommendations for this study as well as recommendations for further studies. The chapter ends with a summary and conclusion.

7.2 SUMMARY OF MAJOR FINDINGS

This section gives a summary of the major findings guided by research objectives, theoretical framework, literature review and empirical findings. The findings are succinctly presented below.

7.2.1 Summary of Empirical Findings

This section presents a summary of empirical findings as guided by the research questions of the study.

7.2.1.1 A comparison between single sex and mixed sex school girls' access and performance in science and technology subjects

Binomial findings on mixed sex and single sex school girls' access to science and technology subjects revealed significant difference (p-value<0.05) in favour of single sex school girls (Table 5.1). Similar findings emerged from their performance where chi-square results depicted (p-value<0.05) difference in performance (Table 5.4). From the above findings, the hypothesis which claimed that there is no significant difference in terms of access and performance between the two categories of learners being compared was rejected.

7.2.1.2 Access and performance findings for boys and girls learning together at a mixed sex school

Access to science and technology subjects between boys and girls learning together at a mixed sex school depicted significant difference in favour of boys, where binomial results showed (p-value<0.05) difference in access (Table 5.2). On the other hand, chi-square results on performance indicated no (p-value>0.05) significant difference (Table 5.5). In view of this, the hypothesis which claimed no significant difference in access between boys and girls at this school was rejected. However, the chi-square results did not reject the null hypothesis which claimed that there is no significant difference in performance between mixed sex school boys and girls. The finding on performance contradict the contention of this study's theoretical framework that if boys' and girls' exposure to the gendered social world is constantly repeated, it solidifies and becomes difficult to uproot from their mental frames (Njogu & Orchardson-Mazrui, 2015:2). With regards to this finding, boys' and girls' exposure to the gendered school environment did not influence their performance in science and technology subjects at school. In fact, boys' and girls' performance in the subject was at par.

7.2.1.3 Access and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school.

Binomial results for mixed sex school boys' and single sex school girls' access to science and technology subjects established (p-value<0.05) significant difference in favour of girls (Table 5.3). In the same vein, their chi-squared performance results in science and technology subjects indicated (p-value<0.05) significant difference in favour of girls (Table 5.6). Therefore, the hypothesis which claimed that there was no significant difference in both access and performance between mixed sex school boys and single sex school female learners at school was rejected.

7.2.1.4 Gender and access to subjects offered by schools

The study revealed that out of nine (Table 5.1, 5.3 & 6.1) science and technology related subjects which fall within this study's scope, the single sex school offered five while the mixed sex school offered eight. This means that the single sex school was denying the girl child of an opportunity to access or study four technology related subjects. These were Metal Work, Wood Work, Building and Technical Graphics.

On the other hand, the mixed sex school which offered eight subjects was denying both boys and girls of an opportunity to access metalwork which it did not offer. Comparatively, a single sex school was worse in terms of denying the girl child access to technology subjects than a mixed sex school because it offered five subjects out of nine compared to eight offered at a mixed sex school (Tables 5.1-5.3 & 6.1). By inference, the presence of more technology related subjects in a mixed sex school (Table 6.1) was meant to cater for boys since the subjects were traditionally regarded as male inclined and more were offered to boys than girls.

Although the mixed sex school denied both boys and girls access from studying metalwork as indicated earlier on, girls can be regarded as disadvantaged more than boys. This is because women have been perceived to be disadvantaged or under-represented in those subjects which have traditionally been regarded as male defined (Mola, 2016:4). Therefore, the aim is not to disadvantage males but to uplift women so that they can be at par with men as well as enhance their access to those subjects which were traditionally labelled as male dominated. Thus, the gender sensitivity in this study is aimed at informing the past and present imbalances with regards to boys' and girls' access to and their performance in science and technology subjects.

In light of these findings, it can be concluded that, schools channel subjects on gender lines because the girl child is disadvantaged in terms of access to science and technology subjects. It is against this background that the school setting can be regarded as gender insensitive because it denies girls, especially those at a single sex, and to a lesser extent, those from a mixed sex school of opportunities to pursue science and technology subjects which form the scope of this study. This finding is not in line with the call by the AU Conference of African Women in Science and Technology (2007) which called for governments to support the full participation of girls and women in science and technology related fields (SARDC, 2016:39).

7.2.1.5 Factors which influence access to science and technology subjects along gender lines

With regards to qualitative findings, factors which influence access to science and technology subjects along gender lines were revealed. These were in favour of boys and are summarised in this section.

7.2.1.5.1 The home has an ideology which is gender biased in favour of men

It emerged from the study that the home has an ideology which is gender biased in favour of men as one teacher indicated that:

> *Parents give tough toys and tasks to boys while soft toys and tasks are for girls. This instills a belief that boys are more powerful and suitable to pursue science and technology subjects than girls. This influences more boys to pursue science and technology subjects than girls. Even parents prefer boys to study science and technology subjects than girls [STS1].*

This implies that boys' and girls' differential choice of subjects at school can be said to have been socially constructed during interaction at home.

7.2.1.5.2 Schools channel science and technology subjects in favour of boys

The study also revealed that teachers, through positive comments for boys and negative comments for girls help to channel boys into science and technology subjects as indicated by teachers that:

> *We (teachers) openly tell learners that science and technology subjects are for boys not girls. Negative comments like, 'Sciences are tough for you' to girls make them aware that they are unequal to boys and that tends to lower their confidence to study the subjects [CTM1].*

In view of the above, teachers' attitudes, and expectations of boys and girls tend to perpetuate a gendered ideology that boys are more powerful and superior than girls. This tends to limit girls' access to science and technology subjects.

7.2.1.5.3 Socialising agents influence subjects channelling on gender lines

The study also revealed that socialising agents influence subjects channelling on gender lines as confirmed by teachers that:

> *Through gender role socialisation, the family, school, media and peers portray boys as more powerful and suitable to pursue science and technology subjects than girls. Socialising agents perceive it as normal for boys to be assigned tough tasks like furniture carrying to boys and sweeping to girls. Parents go to an extent of choosing subjects for their children [CTM9].*

The implication is that, due to gender role socialisation, socialising agents construct boys as more capable than girls and encourage them to pursue science subjects and technology subjects.

7.2.1.5.4 Learners' desire for well-paying careers

On a positive note, the study demonstrated that learners' desire to easily secure well-paying and prestigious jobs is another factor which gave both sexes an encouragement to access science and technology subjects. This view is illustrated by teachers who posited that:

> *Jobs associated with science and technology subjects are prestigious and offer good salaries. More people are drifting towards pursuing the subjects because of that [HODS2].*

This implies that learners' aspirations for better living standards provide an impetus for both boys and girls to choose science and technology subjects at school.

7.2.1.6 Factors influencing school performance in science and technology subjects along gender lines

The study also revealed some factors which influence school performance in science and technology subjects along gender lines. These were revealed by teachers at the two study sites.

7.2.1.6.1 Patriarchal influence on differential performance in science and technology subjects by gender

It emerged from the study that, patriarchal practices in the family help to build confidence in boys, resulting in them performing better than girls in science and technology subjects at school. Evidence to support this view is provided by teachers who claimed that:

> *Assigning tough tasks to boys such as carpentry and light tasks to girls such as sewing boost confidence in boys resulting in them performing better than girls in science and technology subjects at school [CTM7].*

These findings depict that parents play a role in boys' and girls' differential performance at school.

7.2.1.6.2 Teachers' expectations and self-fulfilment on differential school performance in science and technology by gender

The study established that teachers' expectations and self-fulfilment result in differential performance in science and technology by gender at school. This position is supported by teachers who remarked that:

> *Sometimes teachers pass comments like, 'You are failing because you are a girl, I told you that science subjects are for boys because they are difficult'. As a result, boys tend to gather confidence resulting in them performing better than girls [CTS7].*

This demonstrates that through comments, teachers expect boys to perform better than girls in science and technology subjects. Therefore, according to the symbolic interactionism theory, patriarchal ideologies embedded at school tend to result in self-fulfilment in which boys perform better than girls in science and technology subjects (Turner, 2004:343).

7.2.1.6.3 Patriarchal ideologies embedded in society result in boys performing better than girls

The study also demonstrated that patriarchal ideologies peddled by socialising agents, such as the school, home, peers and the media portray boys as more powerful than girls, thereby enhancing their performance in science and technology subjects compared to girls. This was expressed by teachers who concurred that:

> *The family, media, friends and teachers sometimes portray boys as superior and more capable in science and technology subjects tha*
>
> *n girls. Comments such as, 'You have performed like a real boy' are seldom criticised by the socialising agents [STM6].*

In light of these views, the portrayal of women as inferior tends to result in their perform

ance in science and technology subjects being subdued compared to that of men.

7.2.1.6.4 Influence of gender on career choices and school performance in science and technology

Again, it emerged from the study that learners' performance in science and technology subjects is enhanced by their desire for easy passage to careers with good salaries. The finding was confirmed during interviews with teachers who echoed that:

> *Learners know that careers associated with science and technology related subjects offer both prestige and good salaries. So, the answer to this is to perform well in science and technology subjects [HODS1].*

The implication is that, learners' zest to achieve rather than gender is a catalyst to the effort which they exert. Therefore, they realise the need to take an active role and work hard if they are to produce any meaningful outcomes in science and technology subjects

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7.2.1.7 The school as a gender socialising agent of masculinity and femininity through science and technology

Factors with regards to the school as a gender socialising agent of masculinity and femininity through science and technology subjects emerged from the study. These favoured boys and are summarised in this section.

7.2.1.7.1 Teachers' gender 'typification' and stereotyping of science and technology subjects

The study revealed that teachers view science and technology subjects as more suited for boys than girls as indicated by teachers that:

> *Teachers channel subjects on gender lines without realising it. Sometimes teachers tell girls that science and technology subjects are for boys because girls can't manage them [CTM4].*

This implies that teachers channel subjects at school along gender lines. Thus, teachers can be regarded as agents of differential access in science and technology subjects at school.

7.2.1.7.2 School gender bias in science and technology curriculum offering

It emerged from the study that schools do not give boys and girls equal opportunities (in terms of subjects offered) to study science and technology subjects as teachers affirmed that:

> *Some single sex schools like our sister school close to us do not offer building, woodwork, metalwork and technical graphics. This shows that schools are denying girls an opportunity to pursue these subjects [CTM8].*

By not offering certain science and technology subjects, schools can be regarded as agents for gender inequality as they limit girls' access to subjects traditionally labelled as 'masculine' such as those identified by interviewed teachers.

7.2.1.7.3 Adequate gender equity in career counselling

The study established that schools treat learners equally when giving career counselling as expressed by teachers who stated that:

> *We treat boys and girls equally when giving career advice*. *We tell them that anybody can do any job regardless of gender [HODM1].*

Thus, schools have been found to be gender sensitive because they do not treat learners differently.

7.2.1.7.4 Schools differentiate responsibilities on gender lines

The study demonstrated that schools differentiate responsibilities on gender lines as teachers stated that:

> *Light tasks like picking up papers in the classroom are done by girls while tough tasks like movement of heavy furniture are carried out by boys [STM7].*

This means that teachers assign duties at school along gender lines.

7.2.1.7.5 School gender bias in science and technology performance

The study further revealed that, the performance of boys and girls in science and technology subjects is at par. To support the finding teachers highlighted that:

> *The performance between boys and girls in science and technology subjects at both O' and 'A' Levels is at par [STM6].*

This shows similar performance of boys and girls in science and technology subjects at school.

7.2.2 Responding to Research Questions

This study was informed by three quantitative research questions and one qualitative research question. Quantitative research questions sought to establish the presence or absence of any significant difference in terms of boys' and girls' access to and their performance in science and technology subjects at school. Statistical tests were used to compare girls at a single sex and a mixed sex school as well as boys and girls learning together at a mixed sex school using data from a questionnaire for leaners and analysis of 'A' level and 'O' level performance records in science and technology subjects. The tests also compared boys at a mixed sex school and girls at a single sex school in terms of access to and performance in science and technology subjects. The qualitative question sought to explore factors that could influence access to, and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school?

7.2.2.1 More access and better performance in science and technology subjects by single sex than mixed sex school girls

The binomial test (Table 5.1) from school documents namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4), was done to test for association between learners' type of school and the hypothesis, "There is no significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school". The test revealed that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). Therefore, binomial results rejected the null hypothesis which claimed that there is no significant difference in access between mixed sex and single sex school girls.

In terms of numbers, the single sex school girls have higher access to science and technology subjects in all ‘O’ and ‘A’ Level subjects (Table 5.1). This is evidenced by the following enrolment figures: ‘O’ level Physics (93/40), Chemistry (97/43), Agriculture (86/22), Mathematics (253/221) and Integrated Science (242/220) as well as ‘A’ level Mathematics (129/46), Physics (68/16) and Chemistry (93/23). There is gender competition for access in a mixed sex school and that tends to give an advantage to single sex school girls compared to their counterparts at a mixed sex school.

On subjects offered (Table 5.1), it was established that mixed sex school girls had more subjects offered at their school and therefore, had more access. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building as compared to Mathematics, Physics, Chemistry, Integrated Science and Agriculture taught at a single sex school.

With regards to a performance test using documents namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results (Appendix 4), a chi-square test (Table 5.4) was undertaken under the hypothesis, “There is no significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school”. The tests established that there was significant difference ($p<0.05$) in terms of performance in science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.4). In view of the findings, the null hypothesis which claimed that there is no significant difference in performance between mixed sex and single sex school girls was rejected. From this, it would seem the radical feminist proposition of ‘separation’ could hold some water (Samkange, 2015:1173; Talbot, 2015:259). In other words, while it is unrealistic to have a world for women alone, creating more opportunities in education through single sex schools seems to be working.

7.2.2.2 Access and performance in a mixed sex school: More access for boys but performance is at par

The binomial test on mixed sex school boys and girls was done from school documents namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4). The purpose was to test for association between learners' gender and the hypothesis, "There is no significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school". The test indicated that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which was in favour of boys compared to girls (Table 5.2). The null hypothesis which claimed that there is no significant difference in performance between mixed sex school boys and girls was rejected by binomial results.

With regards to enrolment figures (Table 5.2), boys were more than girls in 'O' Level Technical Graphics (41/6), Building (19/3), Wood Work (29/2), Physics (46/40), Chemistry (46/43) and Agriculture (30/22). However, access favoured girls in Mathematics (198/221) and Integrated Science (205/220) only. In all comparable 'A' level subjects namely, Physics (38/16), Mathematics (65/46) and Chemistry (37/23), access in terms of numbers, was in favour of boys. Overall, mixed sex school boys had superior access to science and technology subjects compared to girls. It is worth noting the fact that gender competition at a mixed sex school tended to disadvantage girls than boys.

On subjects offered (Table 5.2), the study revealed that both mixed sex school boys and girls had access to all subjects which formed the scope of this study except Metal Work. These are: Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building. Although both genders were denied access to metalwork, the study considers girls to be more disadvantaged than boys. This is so because women have been perceived to be under-represented in those subjects traditionally labelled as male defined (EC, 2009:13). Therefore, the aim is not to disadvantage males but to uplift women so that they can not only be at par with men, but also enhance their access to those subjects which were offered more to boys than girls. Thus, the gender sensitivity in this study is aimed at informing the past and present imbalances with regards to boys' and girls' access to science and technology subjects.

In terms of performance using documents namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4), a chi-square test (Table 5.5) for association between learners' gender and the hypothesis, "There is no significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school", was done. The test depicted that there was no significant difference ($p>0.05$) in terms of performance in science and technology subjects between boys and girls learning together at the mixed sex school.

This means that, chi-square results did not reject the null hypothesis which claimed that there is no significant difference in performance between mixed sex school boys and girls. Contrary to this study earlier studies revealed that males are smarter than women with regards to performance in science and technology subjects (Gilbreath, 2015:3). This indicates that, the assertion that boys always outperform girls in science and technology subjects can be challenged.

7.2.2.3 More access and better performance in science and technology subjects by single sex school girls than mixed sex school boys

The binomial test (Table 5.3) from school documents namely, the ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4), were done to test for association between learners' gender as well as type of school and the hypothesis, "There is no significant difference in access to and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school". The test revealed that there was significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys (Table 5.3). Thus the binomial results rejected the null hypothesis which claimed that there is no significant difference in access between mixed sex school boys and single sex school girls.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3). These are: ‘O’ Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as ‘A’ level Mathematics (65/129), Physics (38/68) and Chemistry (37/93).

With regards to subjects offered (Table 5.3), it emerged that mixed sex school boys had more access as they are exposed to more science and technology related subjects than girls at a single sex school. The mixed sex school offered Mathematics, Physics, Chemistry, Integrated Science, Agriculture, Technical Graphics, Wood Work and Building while the single sex school offered Mathematics, Physics, Chemistry, Integrated Science and Agriculture. In view of these findings, the school setting can, to a certain extent, be regarded as gender insensitive because it promotes gender differential access to science and technology subjects which were traditionally regarded as male dominated and offered more to boys than girls. Promoting access to science and technology subjects along gender lines is against the Convention on the Elimination of Discrimination in Education (CEDE) (1960) which commits the state parties to formulate, develop and apply a national policy which promotes equality of opportunity and treatment in education without discrimination based on sex, age, ethnicity, language, location and income level (UNESCO, 2012b:19).

On performance, a test using documents namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results (Appendix 4), a chi-square test (Table 5.4) was undertaken under the hypothesis, “There is no significant difference in access to and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school”. The test indicated that there was significant difference ($p<0.05$) in terms of performance in science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys (Table 5.4).

In light of these results, the null hypothesis which claimed that there was no significant difference in performance between mixed sex school boys and single sex school girls was rejected. The reason for this finding may be competition by gender that boys at the mixed sex school are exposed to. Boys and girls learning together at the same school tend to overshadow each other in terms of performance in science and technology subjects.

As a result, single sex school female learners who compete among themselves tend to have an edge over mixed sex school boys in terms of performance in the subjects.

7.2.2.4 Patriarchal ideologies peddled by the family, school, media and peers create an uneven playing field in science and technology learning

A gender biased home ideology in favour of men was identified as one of the factors that influence boys' and girls' access to science and technology subjects at school. Interviewed teachers indicated that:

> *Tough toys for boys and soft toys for girls that children are exposed to as well as the division of labour such as tough tasks for boys and light tasks for girls portray boys as superior and more powerful than girls [STS1].*

The gendered belief that boys are more powerful than girls tends to influence boys to pursue science and technology subjects while girls settle for domestic science subjects and the arts.

It emerged that through positive comments for boys and negative comments for girls, teachers help to channel boys into science and technology subjects and relegate girls to commercials, arts and domestic science subjects. Teachers revealed that teachers make comments like:

> *Science and technology subjects are tough for girls, they are meant for boys [CTM1].*

Such comments boost boys' confidence and make girls believe that they are unequal to boys. Consequently, more boys tend to study science and technology subjects while girls' low confidence drive them to settle for domestic science subjects and the arts. This shows that teachers' attitudes and their expectations of boys and girls can result in learners' differential access to the subjects.

Socialising agents influence girls to pursue domestic science subjects while boys take science and technology subjects at school. Teachers said that:

> *The family, school, media and peers portray boys as more powerful and suitable to pursue science and technology subjects than girls. Socialising agents perceive assigning different tasks like shifting heavy furniture to boys and sweeping to girls as normal and in line with gender role socialisation embedded in society [CTM9].*

Thus, peer pressure, parental influence, teachers' comments and the media's portrayal of females as inferior discourage girls from pursuing science and technology subjects at school. Therefore, socialising agents play an important role in boys' and girls' differential access to science and technology subjects at school.

The study revealed that learners' desire to easily secure well-paying and prestigious jobs also influences their access to science and technology subjects. Teachers indicated that:

> *Jobs associated with science and technology subjects are prestigious and offer good salaries. As a result, more people are pursuing the subjects [HODS2].*

It is evident from the above excerpt that the gender factor is not applicable as what matters most to boys and girls is the desire for better living conditions later in life. Therefore, boys' and girls' access to science and technology subjects is driven or motivated by the availability of good jobs and salaries which science and technology related jobs offer.

With regards to boys' and girls' performance in science and technology subjects, the study found that patriarchal practices in the family result in boys performing better than girls. Teachers asserted that:

> *Assigning tough tasks to boys such as building and light tasks to girls such as sweeping boost confidence in boys resulting in them performing better than girls in science and technology subjects at school [CTM7].*

This means that assigning different tasks to boys and girls portrays girls as weak and inferior to boys. The gender role socialisation which is a product of patriarchal practices, tends to boost boys' confidence resulting in them performing better than girls in science and technology subjects.

The study demonstrated that teachers expect boys to perform better than girls in science and technology subjects at school. Teachers felt that there is gender role bias at school which creates the notion of male superiority as illustrated by one of the teachers who asserted that:

> *Sometimes teachers pass comments like, 'I told you that science and technology subjects are for boys because they are difficult.' As a result, boys tend to gather confidence, resulting in them performing better than girls [CTS7].*

Projecting boys as superior to girls can enhance boys' performance and lower that of girls.

The study established that patriarchal ideologies embedded in society result in boys performing better than girls as stated by teachers thus:

> *The family, media, friends and teachers sometimes portray boys as superior and more capable in science and technology subjects than girls. Often they make comments like, 'Why are you performing like a girl in science and technology subjects?' [STM6].*

Another teacher weighed in:

> *Patriarchal ideologies embedded in society in the form of provision of different toys for boys and girls at home, media bias in favour of boys, negative peer influence and teachers' positive comments to boys alone give confidence for boys to perform better than girls in science and technology subjects [STM6].*

From the above statements, it is evident that patriarchal ideologies such as the provision of different toys for boys and girls at home constructs boys as more capable than girls in science and technology and is responsible for their differential performance in the subjects.

The study revealed that learners pursue science and technology subjects so that they can have easy passage to careers with good salaries. This was highlighted by teachers who asserted that:

> *Learners are aware that careers associated with science and technology related subjects offer both prestige and good salaries. So, the answer to this is to perform well in the subjects [HODS1].*

It is evident that the motivating factor in boys' and girls' performance is the desire to achieve, hence, the gender factor does not count.

The study found that teachers view science and technology subjects as best suited for boys than girls. Teachers indicated that,

> *Teachers channel subjects on gender lines by telling girls that science and technology subjects are for boys because they are tough. Girls should go for arts subjects or even commercials [CTM4].*

This implies that, subject channelling occurs during teacher-learner interaction or through comments which give an impression that girls are not at par with boys in terms of performance in science and technology subjects.

It emerged from the study that schools give an advantage to boys when it comes to giving boys and girls opportunities to study science and technology subjects. Teachers pointed out that:

> *Some schools, especially our single sex sister school near us, are not offering subjects like Technical Graphics, Wood Work, Metal Work and Building thereby denying the girl child an opportunity to study them. This situation seems to be pervasive in other single sex schools across the country [CTM8].*

Another teacher noted that:

> *Even mixed sex schools like ours do not offer certain subjects thereby denying learners an opportunity to pursue the subject [CTM7].*

Thus, schools can be regarded as playing a role in subject channelling along gender lines.

The study found that schools treat learners equally when giving career counselling. Teachers claimed that:

> *We treat boys and girls equally when giving career advice*. *We tell them that anybody can do any job regardless of gender [HODM1].*

Thus, schools have been found to be gender sensitive because they do not treat learners differently. It can therefore, be concluded that equity findings on this aspect echo the propositions of earlier findings by Reeves and Baden (2000;10) who assert that social disadvantages that prevent women and men from enjoying a level playing field in the private and public spheres of life should be eradicated in society.

The study revealed that schools assign tough tasks to boys and light tasks to girls. Teachers emphasised that:

> *Light tasks like picking up papers in the classroom are done by girls while tough tasks like carrying of furniture are carried out by boys [STM7].*

This implies that teachers differentiate responsibilities at school along gender lines. Assigning duties differently, constructs boys as more powerful than girls, thereby, entrenching the inferiority mentality in girls which tends to affect not only their choice of subjects, but also their performance in science and technology.

The study demonstrated that the performance of boys and girls in science and technology subjects is at par. The common view among teachers was that:

> *The performance between boys and girls in science and technology subjects at both O' and 'A' Levels is at par [STM6].*

This implies that the labelling of boys as superior to girls in science and technology subjects did not result in self-fulfilling prophecy (Turner, 2004:343).

This shows that there is no gender that performs better than the other. Contrary to the present study findings, earlier studies by the European Commission (EC) (2009:3) revealed that there are gender inequalities which favour males in terms of subject preferences and performance. In view of these results which indicate parity in performance, the assertion that boys always outperform girls in science can therefore be challenged.

7.2.3 Responding to the study Research Assumption

Most existing studies indicate that there are a number of gender disparities in education that favour males over females with regards to access, performance, treatment and attitudes by educators especially in science and technical focused careers (Runhare, 2003:133; EC, 2009:3; Gilbreath, 2015:3). The present study was undertaken with the assumption that, there is differential treatment at school which favours boys, thereby giving them an advantage over girls in terms of access to and performance in science and technology subjects.

Using findings from the study, this section makes a brief introspection of the research assumption that through interaction or socialisation of gender within a patriarchal society and the school in particular, there is uneven access and performance in science and technology which favours boys and disadvantages girls at the schools where the study was conducted.

Research indicates that the school culture disseminates expectations and messages which expose children to the acquisition of appropriate social values, resulting in differential access and achievement of boys and girls in science subjects (Azimpour & Khalilzade, 2015:20). In line with the above view, it emerged from this study that teachers make discouraging comments to girls like:

> *I told you that, science and technology subjects are for boys because the subjects are tough. You should go for arts subjects or even commercials which you can manage. If you pursue them, you will see that you will struggle a lot [CTS7].*

Such statements by teachers dovetail with the study's theoretical proposition that individuals are influenced to perform differently in science and technology subjects at school due to the inferiority labels for girls and the superiority ones for boys that are constructed at home and entrenched at school during interaction (Turner, 2004: 343; Patowary, 2014:84; Molla, 2016:3). This creates a gendered school culture which is responsible for differential access and performance in science and technology subjects (Koirala & Acharya, 2005:18; Kambarami, 2006:3; Kerkhoven et al, 2016:2). Thus, some patriarchal practices within the school environment could also contribute to an uneven ground in terms of boys' and girls' access to and their performance in science and technology subjects (Mutekwe & Mutekwe, 2012:195; Kangethe et al, 2014:281). This means that differential treatment at school which favours boys could give them an advantage over girls in terms of access to and performance in science and technology subjects.

Based on the majority of views and perceptions of the sampled teachers which implied that boys were stronger and more suitable in science and technology areas of study and careers, as illustrated by a statement by one of teachers cited above (*CTS7)*, it can be concluded that this study's assumption that the school culture, like society at large is also patriarchal and could contribute to the reproduction of an uneven playing field that favours boys more than girls in terms of access and performance in science and technology subjects. This concurs with claims from other researches which suggest that patriarchy in society impacts negatively on the education of the girl child with regards to sciences in general (Kambarami, 2006:3; Azimpour & Khalilzade, 2015:20; Turner, 2004:343; Patowary, 2014:84; Molla, 2016:3;). In Zimbabwe, where the study was conducted, Runhare (2003:133) and Mutekwe and Mutekwe (2012:195) also indicated an imbalance in science and technology that favours males. However, as an indication that not all hope is lost for girls in science and technology, this study revealed that at the girls' single sex school, such an assumption is not always obvious as the study revealed that girls at the school had an upper hand in performance than even boys at a mixed sex school, perhaps because they faced no competition to access in science and technology from boys.

7.3 MAJOR CONCLUSIONS FROM THE STUDY

The purpose of the study was to examine the extent to which, and how gender socialisation affects the education of boys and girls in terms of access to, and performance in science and technology subjects. Central to the study was an examination of the nature of boys' and girls' access to and their performance in science and technology subjects at a mixed sex school and a single sex school. The study's quantitative objectives compared mixed sex school boys' and girls' access to and their performance in science and technology subjects. A comparison between girls in a single sex and those in a mixed sex school was undertaken to ascertain if there were any differences in their access to and performance in science and technology. Another comparison between girls in a single sex school and boys in a mixed sex school was done. Qualitative findings were generated with regards to factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex schools.

In terms of access and performance of girls in science and technology subjects at a single sex and a mixed sex school, the study found that there was significant difference ($p<0,05$) in terms of access to the subjects at school which favoured single sex school girls (Table 5.1). On subjects offered (Table 6.1), mixed sex school girls had more subjects offered at their school and therefore, had more access. With regards to performance, statistical findings depicted significant difference ($p<0,05$) in favour of single sex school girls (Table 5.4).

With regards to access and performance in science and technology subjects for boys and girls at a mixed sex school, the study revealed significant difference ($p<0,05$) in terms of access to the subjects at school in favour of single sex school boys (Table 5.2). In terms of subjects offered (Table 6.1), mixed sex school girls were denied access to building which is perceived to be traditionally male dominated. Failure to avail the subject to girls means that girls remain as disadvantaged as before in traditionally male inclined subjects.

The ideal situation according to this study would be to make available the subjects to both girls and boys because the idea is to uplift girls without necessarily disadvantaging boys in terms of their access to the subjects. Statistical findings on performance indicated no significant difference (p>0,05) between boys and girls learning together at the same school (Table 5.5).

With regards to access to and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school statistical findings indicated that there was a significant difference in terms of access in favour of girls (Table 5.3). This is because in a single sex school all learners are girls who compete among themselves for enrolment space while in a mixed sex school boys compete with girls. The presence of girls in a mixed sex school tends to disadvantage boys in terms of enrolment.

In terms of subjects offered (Table 6.1), mixed sex school boys had more access as they are exposed to more science and technology related subjects than girls at a single sex school. It could be inferred that the availability of more technology related subjects for mixed sex school boys was meant to cater for them since the subjects were traditionally regarded as male inclined and more were offered to boys than girls. On performance, chi-square results (Table 5.6) indicated significant difference in favour of single sex school girls. The reason for this finding may be competition by gender that boys at the mixed sex school are exposed to. Consequently, single sex school female learners who compete among themselves tend to have an advantage over mixed sex school boys in terms of performance in science and technology subjects. This dovetails with the radical feminist's proposition of 'separation' (Talbot, 2015:259; Samkange, 2015:1173).

While it is unrealistic to have a world for women alone, creating more opportunities in education through single sex schools seems to be working.

Qualitative findings on factors which influence boys' and girls' access to and performance in science and technology subjects emerged from the study. It emerged from the study that the home has a gender biased ideology which favours men. The study also revealed that teachers help to track boys into science and technology subjects and relegate girls to commercials, arts and domestic science subjects. They do this through positive comments for boys and negative comments for girls. Again, the study found that, through constructing boys as superior to girls, socialising agents influence girls to pursue domestic science subjects and boys to study science and technology subjects at school. Furthermore, the study demonstrated that learners' desire to easily secure well-paying and prestigious jobs is another factor which motivated boys and girls to study science and technology subjects.

The study also revealed several factors which influence school performance in science and technology subjects along gender lines. Patriarchal practices in the family such as assigning tough tasks to boys and light tasks to girls results in boys performing better than girls in science and technology subjects at school. Tough tasks for boys than girls help to build confidence in boys, resulting in them performing better than girls in science and technology subjects at school. The study found that teachers expect boys to perform better than girls in science and technology subjects at school. This is caused by patriarchal ideologies embedded in society that entrench the notion of male superiority over females. The study also revealed that patriarchal ideologies peddled by socialising agents such as the school, home, peers and the media construct boys as more powerful than girls, thereby enhancing their performance in science and technology subjects compared to girls. It also emerged from the study that learners pursue science and technology subjects so that they can have easy passage to careers with good salaries.

The study revealed important insights with regards to the role of the school in cultivating a gender sensitive culture in relation to boys' and girls' access and performance in science and technology subjects. It was revealed that teachers view science and technology subjects as best suited for boys than girls. It also emerged that schools do not give boys and girls equal opportunities to study science and technology subjects. This was evidenced by the mixed sex school which offered eight subjects compared to five offered by the single sex school. The worst affected in terms of access were single sex school girls followed by mixed sex school girls. It was revealed that schools treat learners equally when giving career counselling hence they were found to be gender neutral in this respect. The study further revealed that schools assign tough tasks to boys and light tasks to girls, thereby affecting their subject choices through portraying boys as superior to girls. The findings of the study also indicated that the performance of boys and girls in science and technology subjects was at par.

7.4 THE STATUS QUO: THE CURRENT NATURE OF BOYS' AND GIRLS' ACCESS AND PERFORMANCE IN SCIENCE AND TECHNOLOGY

A description of the current situation with regards to the nature of boys' and girls' access and performance in science and technology subjects is presented in this section. Recommendations for change as well as a model that is suggested later in this chapter are informed by the need to redress existing factors that promote an uneven gender access and performance in science and technology, as summarised in figure 7.1.

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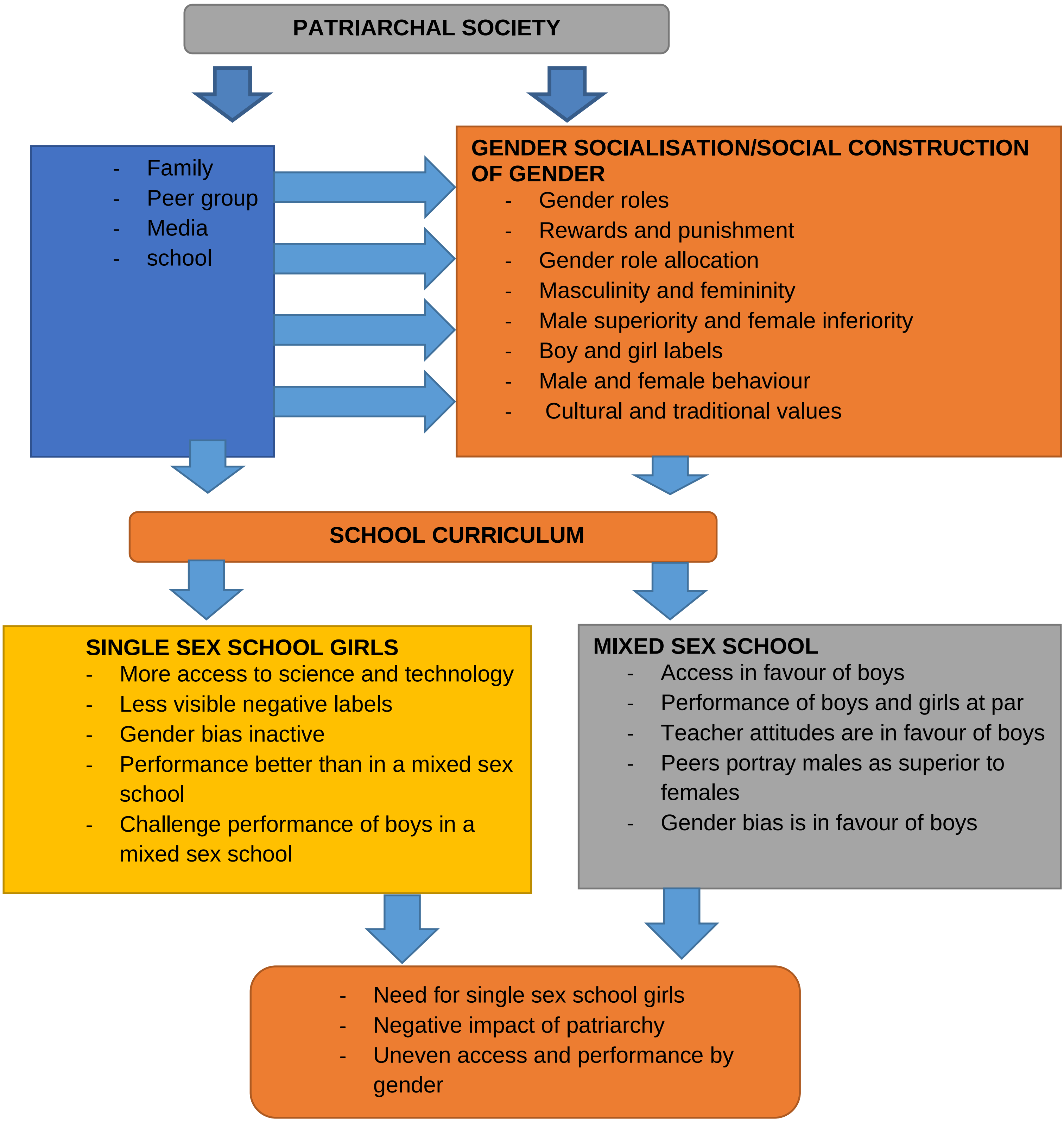

Figure 7.1: The Status quo: Social Factors Promoting Gender Inequality in Science and Technology Subjects

Figure 7.1 presents factors that contribute to uneven access and performance of boys and girls in science and technology subjects at school. The gender role socialisation that rewards conformity to cultural and traditional values and punishes deviation from the norms emerged as a negative factor that creates uneven access and performance of boys and girls in science and technology subjects at school (Patowary, 2014:84). The study revealed that individuals are influenced to perform differently in science and technology subjects at school due to the inferiority labels for girls and the superiority ones for boys that are constructed and entrenched by the socialising agents (Turner, 2004: 343; Molla, 2016:3). Labels instil masculinity duties in boys and femininity tasks in girls resulting in learners accepting socially differentiated roles (Bell, 2008:25). Thus, the creation of a gendered school culture could be responsible for differential access and performance in science and technology subjects (Koirala & Acharya, 2005:18; Kambarami, 2006:3; Kerkhoven et al, 2016:2).

Results on the status quo model, Figure 7.1 revealed differential perceptions, attitudes and treatment that favour boys in terms of access and performance in science and technology subjects at school. Factors that cause uneven access and performance in science and technology subjects which the study revealed such as masculinity and femininity roles, cultural and traditional values, inferiority labels for girls and the superiority ones for boys need to be redressed if gender sensitivity within the school curriculum is to be realised.

7.5 GENERATION OF NEW KNOWLEDGE

7.5.1 Gender parity in school performance gaining ground

Most existing researches indicate that there are a number of gender disparities in education which favour males over females with regards to access, performance, treatment and attitudes by educators (Miroux, 2011:7; Mutekwe & Modiba, 2015:1; Gilbreath, 2015:3). This study was undertaken with the assumption that, “There is differential treatment at school which favours boys, thereby giving them an advantage over girls in terms of access to and performance in science and technology subjects”. However, the assertion that boys always outperform girls in science can be challenged in view of the present study’s findings which indicate parity (p-value>0.05) in performance between boys and girls learning at the same school (Table 5.5). The study has therefore, broken new ground by challenging the assertion that boys always outperform girls in science and technology subjects at school.

7.5.2 Single sex school girls advantage in science and technology

Most current studies found that single sex school girls learn in more conducive environments but their access and performance in science and technology subjects is not better than co-educational school learners (Yalcinkaya & Ulu, 2012:13; Unterhalter, North, Arnot, Lloyd, Moletsane, Murphy-Graham, Parkes & Saito, 2014:1; Marcus & Page, 2016:3). This study was undertaken with the hypothesis that, “There is no significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school”. It was also undertaken with the hypothesis that, “There is no significant difference in access to and performance in science and technology subjects between girls at a single sex school and boys at a mixed sex school”.

The binomial test (Table 5.1) from school documents namely, the ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results (Appendix 4), was done to test for association between learners’ type of school and the hypothesis, “There is no significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school”. The test revealed that there was significant difference (p<0.05) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.1). Therefore, binomial results rejected the null hypothesis which claimed that there is no significant difference in access between mixed sex and single sex school girls.

In terms of numbers, the single sex school girls have higher access to science and technology subjects in all ‘O’ and ‘A’ Level subjects (Table 5.1). This is evidenced by the following enrolment figures: ‘O’ level Physics (93/40), chemistry (97/43), agriculture (86/22), mathematics (253/221) and integrated science (242/220) as well as 'A' Level mathematics (129/46), physics (68/16) and chemistry (93/23). There is gender competition for access to science and technology subjects in a mixed sex school and that tends to give an advantage to single sex school girls compared to their counterparts at a mixed sex school.

Chi-square tests established that there was significant difference ($p<0.05$) in terms of performance in science and technology subjects at school which favoured single sex school girls compared to mixed sex school girls (Table 5.4). In view of the findings, the null hypothesis which claimed that there is no significant difference in performance between mixed sex and single sex school girls was rejected. From this, it would seem the radical feminist proposition of 'separation' could hold some water (Samkange, 2015:1173; Talbot, 2015:259). In other words, while it is unrealistic to have a world for women alone, creating more opportunities in education through single sex schools seems to be working.

Binomial findings from ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4), established significant difference ($p<0.05$) in terms of access to science and technology subjects at school which favoured single sex school girls compared to mixed sex school boys (Table 5.3). Therefore, the null hypothesis which claimed no significant difference in terms of mixed sex school boys' and single sex school girls' access to science and technology subjects at school is rejected.

In terms of numbers, single sex school girls had higher access to science and technology subjects in all comparable 'O' and 'A' Level subjects (Table 5.3) than mixed sex school boys. These are: 'O' Level Integrated Science (205/242), Mathematics (198/253), Physics (46/93), Chemistry (46/97) and Agriculture (30/86) as well as 'A' Level Mathematics (65/129), Physics (38/68) and Chemistry (37/93).

Performance results from single sex school girls and mixed sex school boys using school documents, namely: ZIMSEC 2016 – 2017, 'O' and 'A' Level final national examinations results (Appendix 4) depicted significant difference that favoured single sex school girls (Table 5.6). In light of these findings, it is evident that there is significant difference that favours single sex school girls in terms of performance in science and technology subjects between single sex school girls and mixed sex school boys. The null hypothesis which claimed no significant difference with regards to single sex school girls' and mixed sex school boys' performance in science and technology subjects at school is thus, rejected. The reason for this finding may be competition by gender that boys at the mixed sex school are exposed to. Consequently, single sex school female learners who compete among themselves tend to have an advantage over mixed sex school boys in terms of performance in science and technology subjects.

7.6 RECOMMENDATIONS FROM THIS STUDY

This section outlines the study's findings followed by recommendations emanating from these findings. The recommendations relate to on factors that could influence access to, and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

7.6.1 Advocacy programmes to eradicate gender biased ideologies

The study found that the home is gender biased in favour of men by tracking boys into science and technology subjects while girls are channelled to study domestic science subjects and the arts. Teachers were unanimous that parents give tough toys and tasks to boys while soft toys and tasks are for girls. Teachers also concurred that media bias is in favour of boys and negative peer influence instil the belief that boys are more dominant and suitable to pursue science and technology subjects than girls. Consequently, more boys tend to be influenced to pursue and perform better in science and technology subjects than girls. The study recommends family dialogues on gender roles. The study also recommends the initiation of advocacy programmes by the Ministry of Primary and Secondary Education. These can be in the form of building community-based libraries with gender neutral material such as textbooks, literature and magazines to foster gender sensitivity in private and public spheres. The advocacy programmes should be aimed at uprooting ideologies which perpetuate male superiority and female inferiority and should be cascaded to lower levels of society and schools. This way gender inequality will be minimised in society and may result in equal performance in science and technology subjects among boys and girls.

7.6.2 Importance of gender sensitivity in science and technology

It emerged from the study that mixed sex school teachers help to track boys into science and technology subjects and relegate girls to domestic science subjects and the arts. Teachers concurred that they channel science and technology subjects along gender lines through positive comments for boys and negative comments for girls. They also admitted that schools differentiate responsibilities on gender lines, for example light tasks like picking up papers in the classroom are done by girls while tough tasks like movement of heavy furniture are carried out by boys. This means that teachers perpetuate a gendered ideology that boys are more powerful and superior than girls. This limits girls' access to science and technology subjects. The study recommends that, the Ministry of Primary and Secondary Education should produce gender sensitive textbooks in schools that conscientise teachers about the importance of gender neutrality in aspects of the school curriculum, including access to science and technology subjects at school.

7.6.3 Training of socialising agents on effects of gender on school curriculum

The study revealed that socialising agents such as the family, school, peers and the media influence girls to pursue domestic science subjects and boys to study science and technology subjects at school. Teachers were unanimous in their belief that through gender role socialisation, the family, school, media and peers portray boys as more powerful and suitable to pursue science and technology subjects than girls. Socialising agents normalise the belief that boys should to be assigned tough tasks like furniture carrying while girls are given light tasks such as sweeping. Some parents go to the extent of choosing subjects for their children. The implication is that due to gender role socialisation, socialising agents perceive boys as more capable than girls and encourage them to pursue science subjects and technology subjects. It is recommended that, the Ministry of Primary and Secondary Education should conduct seminars to educate people about gender sensitivity. These seminars should be cascaded to grassroots levels. The study also recommends provision of national legislative platforms as well as dialogue and review of national, regional and international statutes on gender inequalities to redress the perception that boys are more capable than girls in science and technology subjects.

7.6.4 Gender sensitive literature and practices in science and technology

The study demonstrated that patriarchal practices in the family result in boys performing better than girls in science and technology subjects at school. Teachers indicated that patriarchal practices in the family such as assigning tough tasks to boys and light tasks to girls boost confidence in boys, resulting in them performing better than girls in science and technology subjects at school. This helps to build confidence in boys resulting, in boys performing better than girls in science and technology subjects. The study recommends that the Ministry of Primary and Secondary Education should make available gender sensitive textbooks to the grassroots level so that people can be conscientised on the importance of creating an even playing field between men and women in the private and public spheres of life, including performance in science and technology subjects.

7.6.5 Gender sensitivity modules in teacher training

The study found that teachers expect boys to perform better than girls in science and technology subjects at school. This position is supported by teachers who indicated that they sometimes make comments telling girls that they are failing because they are girls. They tell learners that science and technology subjects are for boys because they are difficult. The implication is that teachers lack gender neutrality in terms of pedagogy involving science and technology subjects. It is recommended that, the Ministry of Primary and Secondary Education should deploy experts on gender issues whose mandate is to minimise the perpetuation of gender disparities in many facets of the school curriculum, including boys' and girls' performance in science and technology subjects. Again, gender sensitivity should be taught as a module to student teachers in universities and colleges in the country. This would help to conscientise school-based stakeholders and the society at large about the importance of gender sensitivity in aspects of the school curriculum, including boys' and girls' performance in science and technology subjects at school.

7.6.6 Science and technology curriculum offering policy

It emerged from the study that schools do not give boys and girls equal opportunities to study science and technology subjects as teachers emphasised that some single sex schools do not offer Building, Wood Work, Metal Work and Technical Graphics. This shows that schools are denying girls, especially those in single sex schools of an opportunity to pursue the subjects. By not offering certain science and technology subjects, schools can be regarded as agents for gender inequality as they limit girls' access to subjects traditionally labelled as masculine. It is recommended that the Government of Zimbabwe should craft a policy that makes it mandatory for schools to teach all subjects that were labelled as masculine and offered more to boys than girls. This would help to ensure equal access to science and technology subjects among boys and girls.

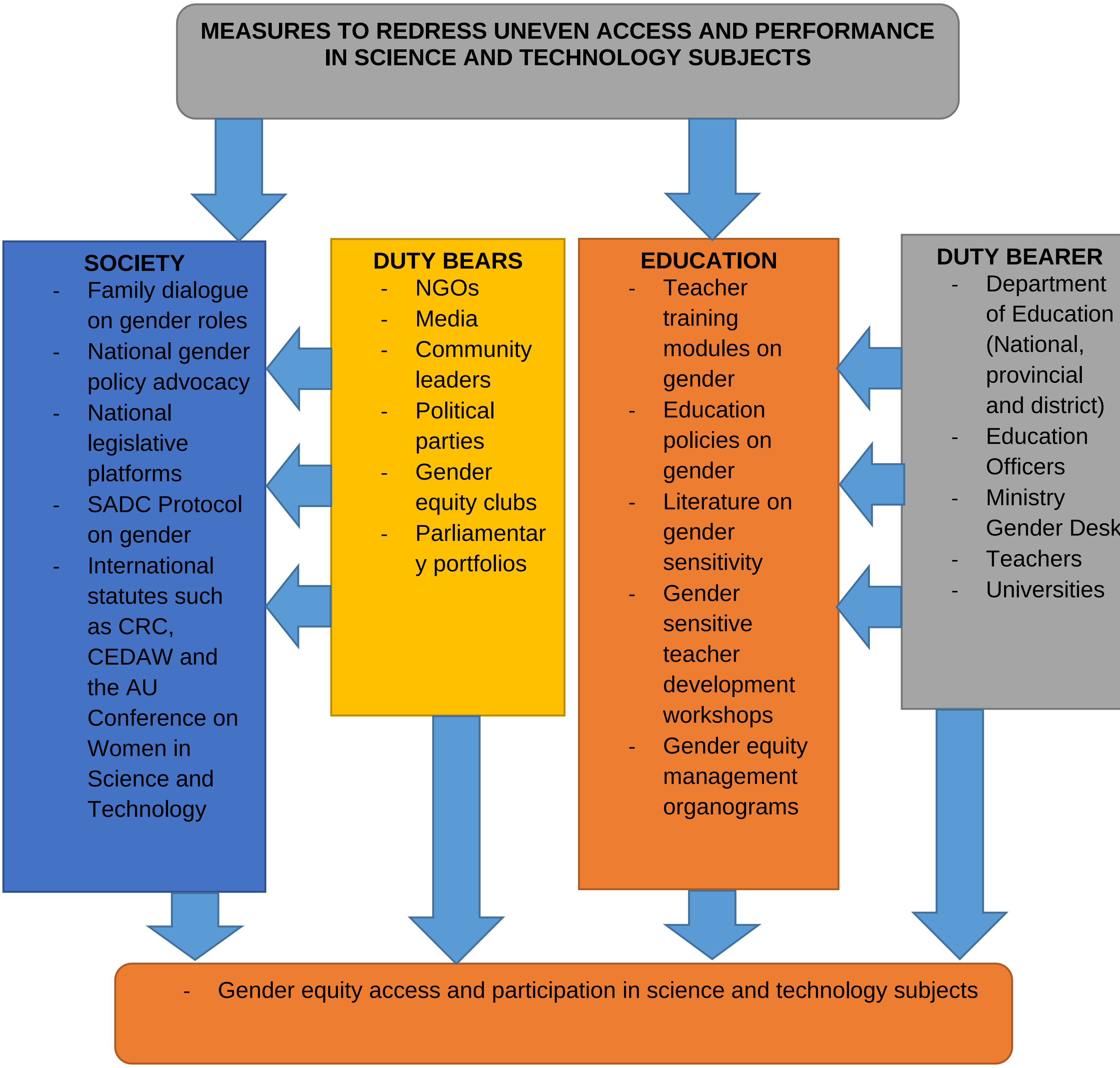

Figure 7.2: Model for a Gender Sensitive Society and Education

The model, Figure 7.2 is based on the premise that the school is a microcosm of patriarchy in that we cannot have a patriarchal society and gender sensitive sub-institutions like a family or a school under the same roof (Obiunu, 2013:88). If society expects the girl child not to be as good as the boy child in science and technology subjects, this is reflected by the school which is a unit of the society (Marinova, 2003:2). Thus, schools may promote what society expects (Masanja, 2010:1). It is against this background that the gender role socialisation that is evident at school and has its roots in the family is perceived to have emerged as a powerful determinant not only in terms of learners' access to and their performance in science and technology subjects, but also in their career trajectories (Kangethe et al, 2014:280). It is therefore, imperative to create a gender sensitive school environment which has the potential to foster a gender-neutral education system that can promote equality in terms of boys' and girls' access to and performance in science and technology subjects.

In line with the study's findings, the uneven playing field in terms of boys' and girls' access to and their performance in science and technology subjects should be redressed. Patriarchal ideologies embedded in society and the school should be deconstructed so that a gender sensitive school environment can be realised. Seminars, advocacy programmes, gender sensitive literature and modules, deployment of gender sensitive experts and policies to make the teaching of science and technology subjects which were labelled as masculine mandatory are recommended measures aimed at ensuring that patriarchal ideologies at school are deconstructed. Other measures that can be instituted to redress patriarchal influences on schooling in science and technology subjects are family dialogues on gender roles, National Legislative Platforms as well as national, regional and international statutes on gender inequalities.

7.7 RECOMMENDATIONS FOR FURTHER STUDIES

This study has established a basis for further studies on gender sensitivity in the teaching and learning of science and technology subjects with specific focus on comparing boys' and girls' access to and their performance in the subjects. Since this was a case study of only single and mixed sex schools, studies utilising a wider scope of district and provincial participants such as education inspectors, parents and non-teaching staff can be conducted to yield significant and more generalisable research findings. Rahman (2017:105) posits that studies utilising a wider scope elicit insights from diverse research participants thereby yielding wider generalisation to other contexts.

One important influence of gender equity issues in society is the family and community (Singh, 2016:27). In this study, although participants were asked about their views on parents and the family, the parents and community members did not actually participate in the study. It is therefore important for research that focuses on community and parental views and perceptions on teaching and learning of science and technology on gender lines.

Methodologically, this study did not make live observations at school based education stakeholders such as teachers, heads of departments, school principals and non-teaching staff on how they reacted and treated students according to gender. Further studies that could include participant and non-participant observations in the process of teaching and learning on a daily basis are recommended. Participant observations do not only enable the researcher to observe events that participants may be unable or unwilling to share with researchers but also facilitates the researcher’s involvement in sensitive activities to which he or she generally would not be invited (Kawulich, 2005:3). They also reduce incidences of ‘reactivity’ or people acting in a certain way when they are aware of being observed (Brackett, Reid & Green, 2007:191).

According to the United Nations Girls’ Education Initiative (UNGEI) (2012:5), policy analysis and review are critical aspects for initiating change. At times policy and curriculum implementers may not be aware of policies that could be available. Further to this, policies for guiding education stakeholders on gender equity in education might actually be unavailable at national, ministerial and school levels. Studies on policy analysis, which this study did not venture into are also recommended to augment the current study.

7.8 LIMITATIONS OF THE STUDY

Although relevant documents were analysed in the quantitative strand of the research and a wide range of participants were interviewed in the qualitative study to achieve an in-depth exploration of the topic, only two schools were selected because they suited the specified objectives of the study. More schools rather than two could have been considered to yield more generalisable research findings. However, the study remains valid in terms of research rigour, depth, accuracy and triangulation of instruments.

Although the study included heads of schools, their deputies, science and technology subjects HODs, science and technology subjects class teachers and science and technology subject teachers who are the key stakeholders at school level, other participants such as the district and provincial inspectors, parents and non-teaching staff could have been included for a wider perspective on factors that influence boys' and girls' access to and their performance in science and technology subjects. They were however excluded because of the need to delimit the study to a specific scope for thoroughness. The perceptions of other stakeholders on the nature of boys' and girls' access to and their performance in science and technology subjects could however, be considered in another study as suggested in the section on further studies.

7.9 CHAPTER SUMMARY

The purpose of the study was to explore how gender socialisation affects the education of boys and girls in terms of access to, and performance in science and technology subjects. The examination of the nature of access to and performance in science and technology subjects by boys and girls at mixed sex and single sex schools was the central focus in this study. Quantitatively, the study sought to ascertain if there was any significant difference in access to and performance in science and technology subjects between girls in single sex and those in mixed sex schools. Boys and girls learning together at a mixed sex school were compared to establish if there was any significant difference in access to and performance in science and technology subjects. A comparison between girls in a single sex school and boys in a mixed sex school was undertaken.

Statistical findings revealed significant differences in terms of both access to and performance in science and technology subjects which favoured single sex school girls compared to their mixed sex school counterparts. Therefore, the hypotheses which claimed that there is no significant difference in both access and performance were rejected. In terms of subjects offered, mixed sex school girls were denied access to four technology related subjects. These were Technical Graphics, Building, Wood Work and Metal Work.

It emerged from statistical results that there was significant difference on access between boys and girls learning together, which was in favour of single sex school boys. Therefore, the hypothesis which claimed that there was no significant difference was rejected. In terms of subjects offered, mixed sex school girls were denied access to metalwork. Statistical findings on performance indicated no significant difference between boys and girls learning together at the same school as their performance was at par. The hypothesis which claimed no significant difference was accepted.

Statistical findings revealed that there was significant difference between single sex school girls and mixed sex school boys in terms of both access to and performance in science and technology subjects which favoured single sex school girls. The hypothesis which claimed that there was no significant difference was rejected. In terms of subjects offered, mixed sex school boys had more access as they were exposed to more science and technology related subjects than girls at a single sex school. Single sex school girls were denied access to Technical Graphics, Building, Wood Work and Metal Work.

The qualitative strand of the study found that there is differential treatment at school which favours boys, thereby giving them an advantage over girls in terms access to and performance in science and technology subjects. It emerged that socialising agents namely, the media, home, school and peers promote a patriarchal ideology which favours boys than girls and help to track more boys than girls into science and technology subjects. On factors that influence school performance in science and technology subjects on gender lines; the findings revealed that patriarchal ideologies embedded in society create a notion of male superiority over females. This was echoed by teachers who were of the view that the school, home, peers and the media portray boys as more powerful than girls, thereby enhancing not only their access in science and technology but also their performance in the subjects compared to girls. The findings of this study concurred with the research assumption which claimed that there is differential treatment at school which favours boys in terms access to and performance in science and technology subjects.

The study's limitations were that the two schools selected for the study could not represent all the schools in Zimbabwe. Therefore, the findings of this study cannot be generalised beyond schools whose demographic characteristics match the schools where the study was conducted. Despite this limitation, the study is still valid in terms of rigor, depth, accuracy and triangulation of instruments. Another limitation was that participants such as district and provincial inspectors, parents and non-teaching staff were excluded because of the need to delimit the study to a specific scope for thoroughness. Their inclusion could have provided a wider perspective on factors that could influence boys' and girls' access to and their performance in science and technology subjects.

The study generated new knowledge by challenging the assertion that there are a number of gender disparities in education that are in favour of males over females with regards to access, performance, treatment and attitudes by educators. Findings from this study revealed parity in performance between boys and girls learning together at the same school.

Future studies could utilise more research participants such as district and provincial inspectors, parents and non-teaching staff at schools to yield significant outcomes on the phenomenon under investigation. A similar study could be conducted focusing on more study sites or a wider research boundary.

Various recommendations were proffered to ensure gender neutrality is realised in society in general and schools specifically.

The study recommended family dialogues on gender roles, gender sensitive seminars in communities, government advocacy programmes that cascade to lower levels of society and schools to redress gender bias and the provision of gender sensitive textbooks in schools by the Ministry of Primary and Secondary Education. The study also recommended the teaching of gender sensitive modules to student teachers, deployment of gender experts in schools, building community-based libraries and crafting of policies to make the teaching of science and technology subjects mandatory. Furthermore, the provision of national legislative platforms as well as dialogue and review of national, regional and international statutes on gender inequalities can redress the perception that boys are more capable than girls in science and technology subjects. These measures could address inequalities in relation to access and performance in science and technology subjects between boys and girls.

7.10 CONCLUSION

The main aim of this study was to examine how gender socialisation affects boys' and girls' access to and their performance in science and technology subjects. The study sought to determine and explore factors that could influence access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools in Zimbabwe. It was a comparative case study of one single and one mixed sex high school in Zimbabwe.

The study was a mixed method study with a convergent parallel design. It was underpinned by the pragmatic philosophical world view and underpinned by the symbolic interactionism theory.

This study had two samples: one for the quantitative strand and the other for the qualitative strand. The probability stratified random sampling method was adopted for the quantitative sample size and comprised of 112 boys and girls from a mixed sex school and 81 girls from a single sex school. The qualitative sample size from the two study sites consisted of 44 purposively sampled teachers. Of these, 23 were from a mixed sex school while 21 were from a single sex school. Quantitative data were gathered through questionnaire schedules and school documents namely, ZIMSEC 2016 – 2017, ‘O’ and ‘A’ Level final national examinations results while the qualitative data was gathered through interviews. Quantitative data presentation and analysis were done statistically using chi-square and binomial tests while qualitative data from interviews were presented and analysed thematically and in purely descriptive form. Quantitative and qualitative results were discussed separately before merging them to compare, contrast and corroborate results from the two strands. The merged findings were then discussed by placing them in the broader context of related literature.

Statistical tests (Table 5.1) revealed that there was significant difference between single sex and mixed sex school girls in terms of both access to ($p>0.05$) and performance in ($p>0.05$) science and technology subjects at school which favoured single sex school girls. The hypothesis which claimed that there is no significant difference in access (Table 5.1) and performance (Table 5.4) was rejected. In terms of subjects offered (Table 6.1), mixed sex school girls had more subjects offered at their school and therefore, had more access.

On boys and girls learning together at a single sex school, binomial tests (Table 5.2) on access revealed significant difference ($p>0.05$) in favour of single sex school boys. Therefore, the hypothesis which claimed that there is no significant difference was rejected. In terms of subjects offered (Table 6.1), mixed sex school girls were denied access to a subject which is perceived to be traditionally male dominated. By not availing the subject to girls, differential access to science and technology subjects remain entrenched in the school culture. Chi-square results on performance (Table 5.5) indicated no significant difference ($p>0.05$) between boys and girls learning together at the same school. Their performance was at par. The hypothesis which claimed that there is no significant difference was accepted.

Binomial results on single sex school girls and mixed sex school boys (Table 5.3) showed significant difference ($p<0.05$) in access to science and technology subjects which favoured single sex school girls. The hypothesis which claimed the absence of any significant difference was rejected. In terms of subjects offered (Table 6.1), mixed sex school girls had more access as they are exposed to more science and technology related subjects than girls at a single sex school. On performance, chi-square results (Table 5.6) depicted significant difference (0.05) in favour of single sex school girls. The hypothesis which claimed that there is no significant difference was rejected.

A gender-biased home ideology in favour of men was identified as one of the factors that influences boys' and girls' access to science and technology subjects at school. Teachers indicated that the types of toys that children are exposed to and the division of labour which portrays boys as superior to girls reinforced a gendered belief which influences boys to pursue science and technology subjects while girls settle for domestic science subjects and the arts. It also emerged that teachers, through positive comments for boys and negative comments for girls help to channel boys into science and technology subjects and relegate girls to commercials, arts and domestic science subjects.

Teachers revealed that educators' positive comments to boys doing science and technology subjects instil confidence in them hence they opt to study science and technology subjects while girls' low confidence drive them to settle for domestic science subjects and the arts. The implication is that teachers' attitudes and expectations of boys and girls can result in learners' differential access to the subjects. Socialising agents influence girls to pursue domestic science subjects and boys to study science and technology subjects. Peer pressure, parental influence, teachers' comments and the media portrayal discourage girls from pursuing science and technology subjects at school. It could be concluded that socialising agents play a role in boys' and girls' differential access to science and technology subjects at school. It emerged from the study that, some schools, especially single sex schools are not offering subjects like Technical Graphics, Wood Work, Metal Work and Building, thereby denying the girl child an opportunity to study them. The study also revealed that, even mixed sex schools do not offer certain subjects like metalwork, thereby denying learners, especially the girl child an opportunity to pursue the subject. This means that schools play a role in subject channelling along gender lines.

With regards to boys' and girls' performance in science and technology subjects, the study established that, patriarchal practices such as giving car toys to girls and female dolls to girls in the family result in boys developing superiority mentality over girls. Consequently, they tend to perform better than girls in science and technology subjects at school. Teachers indicated that assigning different tasks such as building to boys and sweeping to girls construct girls as weak and inferior to boys. The gender role socialisation which is a product of patriarchal practices, tends to boost boys' confidence, resulting in them performing better than girls in science and technology subjects. The study also demonstrated that teachers expect boys to perform better than girls in science and technology subjects at school. Teachers felt that there is gender role socialisation at school which creates a notion of male superiority over females but were doubtful whether that can affect performance between boys and girls.

Teachers were unanimous in their view that through their comments they expect boys to perform better than girls though the situation on the ground may be different. Again, the study established that patriarchal ideologies peddled by socialising agents such as the school, peers, mass media and the family result in boys performing better than girls. Teachers pointed out that tough toys for boys and soft ones for girls and division of labour in which boys are assigned tough tasks like carpentry as opposed to paper picking for girls are perceived as normal even by socialising agents. Teachers made positive comments to boys pursuing science and technology subjects but did the opposite to girls studying the same subjects. Such comments are viewed as responsible for boys' and girls' differential performance in science and technology subjects.

The study's findings which indicate parity in performance between boys and girls learning together at the same school generated new knowledge by challenging the assertion that boys always outperform girls in science and technology subjects at school. The study's limitations were that the two schools selected for the study could not be generalised beyond schools whose demographic characteristics match the schools selected for the study. However, the study remains valid in terms of research rigour, depth, accuracy and triangulation of instruments. Another limitation was that participants such as the district and provincial inspectors, parents and non-teaching staff were excluded. These could have provided a wider perspective on factors that could influence boys' and girls' access to and their performance in science and technology subjects. They were however excluded because of the need to delimit the study to a specific scope for thoroughness. For further studies, this research has recommended the utilisation of more research participants such as district and provincial inspectors, parents and non-teaching staff at schools to yield significant outcomes on the phenomenon under investigation.

In addition, similar studies could be conducted focusing on more study sites or a wider research boundary. Various recommendations were proffered to ensure gender neutrality is realised in society in general and in schools specifically. The study concluded by recommending family dialogues on gender roles, gender sensitive seminars in communities, government advocacy programmes, gender sensitive textbooks in communities and schools, gender sensitive modules to student teachers, deployment of gender experts in schools and crafting of policies to make the teaching of science and technology subjects mandatory. The study also recommended provision of national legislative platforms as well as dialogue and review of national, regional and international statutes on gender inequalities to redress the perception that boys are more capable than girls in science and technology subjects.

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APPENDICES

Appendix 1: University of Venda Higher Degrees Committee project approval

UNIVERSITY OF VENDA

OFFICE OF THE DEPUTY VICE-CHANCELLOR: ACADEMIC

TO : MR/MS H ZIGARA
SCHOOL OF EDUCATION

FROM: PROF J.E. CRAFFORD
DEPUTY VICE-CHANCELLOR: ACADEMIC

DATE : 05 DECEMBER 2016

DECISIONS TAKEN BY UHDC OF 29 NOVEMBER 2016

Application for approval of Thesis research proposal in School of Education: H. Zigara (16023513)

Topic: "Pedagogic Gender sensitivity in the Teaching and Learning of Science and Technology: A Comparative Case Study of single and mixed sex High Schools in Zimbabwe."

Promoter	UNIVEN	Prof. T. Runhare
Co-Promoter	UNIVEN	Dr. N.F Litshani

UHDC approved Thesis proposal

Prof J.E. CRAFFORD
DEPUTY VICE-CHANCELLOR: ACADEMIC

Appendix 2: Ethical Clearance Certificate

RESEARCH AND INNOVATION
OFFICE OF THE DIRECTOR

NAME OF RESEARCHER/INVESTIGATOR:
Mr H Zigara

Student No:
16023531

PROJECT TITLE: **Pedagogic gender sensitivity in the teaching and learning of science and technology: A comparative case study of single and mixed sex high schools in Zimbabwe.**

PROJECT NO: SEDU/17/CSEM/05/2906

SUPERVISORS/ CO-RESEARCHERS/ CO-INVESTIGATORS

NAME	INSTITUTION & DEPARTMENT	ROLE
[illegible]	University of Venda	Promoter
[illegible]	University of Venda	Co- Promoter
Mr H Zigara	University of Venda	Investigator – Student

ISSUED BY:
UNIVERSITY OF VENDA, RESEARCH ETHICS COMMITTEE

Date Considered: June 2017
Decision by Ethical Clearance Committee Granted
Signature of Chairperson of the Committee: ....
Name of the Chairperson of the Committee: Prof. G.E. Ekosse

UNIVERSITY OF VENDA
DIRECTOR
RESEARCH AND INNOVATION
2017 -07- 03
Private Bag X5050
Thohoyandou 0950

University of Venda
PRIVATE BAG X5050, THOHOYANDOU, 0950), LIMPOPO PROVINCE, SOUTH AFRICA
TELEPHONE (015) 962 8504/8313 FAX (015) 962 9060
"A quality driven financially sustainable, rural-based Comprehensive University"

APPENDIX 3: PERMISSION LETTER FROM THE MINISTRY OF PRIMARY AND SECONDARY EDUCATION - ZIMBABWE

All communications should be addressed to "The Secretary for Primary and Secondary Education"
Telephone: 799914 and 705153
Telegraphic address : "EDUCATION"
Fax: 791923

ZIMBABWE

Reference: C/426/3
Ministry of Primary and Secondary Education
P.O Box CY 121
Causeway
Harare
ZIMBABWE

24 April 2018

MIN OF PRY & SEC. EDUCATION HUMAN RESOURCES (DISCIPLINE) MIDLANDS
25 JUN 2018
P.O BOX 737 GWERU ZIMBABWE

Herbert Zigara
House Number 6907
Mkoba 18
Gweru

RE: PERMISSION TO CARRY OUT RESEARCH IN MIDLANDS PROVINCE: GWERU DISTRICT: THORNHILL AND REGINA MUNDI HIGH SCHOOLS

Reference is made to your application to carry out a research in the above mentioned schools in Midlands Province on the research title:

"PEDAGOGICAL GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATICE STUDY OF SINGLE AND MIXED SEC HIGH SCHOOLS IN ZIMBABWE"

Permission is hereby granted. However, you are required to liaise with the Provincial Education Director Midlands, who is responsible for the schools which you want to involve in your research. You are required to seek consent of the parents/ guardians of all learners who will be involved in the research.

You are required to provide a copy of your final report to the Secretary for Primary and Secondary Education.

MIN OF PRY & SEC EDUCATION POLICY PLANNING RESEARCH AND DEVELOPMENT
03 MAY 2018
P.O. BOX CY 121 CAUSEWAY ZIMBABWE

J. Gonese
ACTING SECRETARY FOR PRIMARY AND SECONDARY EDUCATION

THORNHILL HIGH SCHOOL
JUN 2018
P.O BOX 656

APPENDIX 4: DOCUMENT ANALYSIS PROTOCOL (ZIMSEC, 2016 – 2017 "O" AND "A" LEVEL FINAL NATIONAL EXAMINATIONS RESULTS FROM A SINGLE SEX AND A MIXED SEX SCHOOL)

2016 'O' Level. Single Sex School

	CANDIDATES			MALE						FEMALE								PERCENTAGE PASS RATE			
SUBJECT	TOTAL	M	F	A	B	C	D	E	U	A	B	C	D	E	U	M	%	F	%	Tot	%
English Language	135	0	135	0	0	0	0	0	0	50	64	20	1	0	0	0	0	134	99.26	134	99.26
Lit In English	95	0	95	0	0	0	0	0	0	53	30	11	1	0	0	0	0	94	98.95	94	98.95
Religious Studies	134	0	134	0	0	0	0	0	0	19	24	39	20	1	31	0	0	82	61.19	82	61.19
History	135	0	135	0	0	0	0	0	0	78	30	19	5	3	0	0	0	127	94.07	127	94.07
Geography	135	0	135	0	0	0	0	0	0	71	43	17	2	2	0	0	0	131	97.04	131	97.04
Shona	132	0	132	0	0	0	0	0	0	86	36	7	3	0	0	0	0	129	97.73	129	97.73
Maths	135	0	135	0	0	0	0	0	0	37	25	39	8	5	21	0	0	101	74.81	101	74.81
Int. Science	129	0	129	0	0	0	0	0	0	54	43	29	3	0	0	0	0	126	97.67	126	97.67
Biology	94	0	94	0	0	0	0	0	0	10	51	27	6	0	0	0	0	88	93.62	88	93.62
Fashion & Fabrics	34	0	34	0	0	0	0	0	0	22	11	1	0	0	0	0	0	34	100	34	100
Agriculture	52	0	52	0	0	0	0	0	0	15	30	7	0	0	0	0	0	52	100	52	100
Physics	47	0	47	0	0	0	0	0	0	4	22	19	1	0	1	0	0	45	95.74	45	95.74
Chemistry	47	0	47	0	0	0	0	0	0	11	14	17	2	3	0	0	0	42	87.36	42	87.36
Computer Studies	29	0	29	0	0	0	0	0	0	2	22	5	0	0	0	0	0	29	100	29	100
Principles of Accounts	131	0	131	0	0	0	0	0	0	65	24	26	6	5	5	0	0	115	87.69	114	87.79
Commerce	1	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	100	1	100

Overall percentage pass rate = 98.52%

The information given above is certified correct.

Signature: ______________________________ Designation: _______________ Date: ___

2017 "O" Level. Single Sex School

SUBJECT	CANDIDATES			MALE						FEMALE								PERCENTAGE PASS RATE			
	TOTAL	M	F	A	B	C	D	E	U	A	B	C	D	E	U	[illegible]	X	F	%	Tot	%
English Language	118	0	118	0	0	0	0	0	0	42	69	7	0	0	0	0	0	118	100	118	100
Lit in English	76	0	76	0	0	0	0	0	0	6	40	24	5	1	0	0	0	70	92.11	70	92.11
Religious Studies	115	0	115	0	0	0	0	0	0	71	25	14	0	1	3	0	0	111	96.52	111	96.52
History	118	0	118	0	0	0	0	0	0	80	17	1	1	2	2	0	0	113	95.76	113	95.76
Geography	118	0	118	0	0	0	0	0	0	93	14	1	3	0	0	0	0	115	97.46	115	97.46
Shona	116	0	118	0	0	0	0	0	0	40	42	26	5	2	1	0	0	108	93.10	108	93.10
Maths	118	0	118	0	0	0	0	0	0	50	30	19	3	7	9	0	0	99	83.90	99	83.90
Int. Science	113	0	113	0	0	0	0	0	0	32	44	19	12	5	1	0	0	95	84.07	95	84.07
Biology	92	0	92	0	0	0	0	0	0	13	54	17	5	2	1	0	0	84	91.30	84	91.30
Fashion & Fabrics	29	0	29	0	0	0	0	0	0	22	5	2	0	0	0	0	0	29	100	29	100
Agriculture	34	0	34	0	0	0	0	0	0	13	17	7	2	0	0	0	0	32	94.12	32	94.12
Physics	46	0	46	0	0	0	0	0	0	16	22	7	1	0	0	0	0	45	97.83	45	97.83
Chemistry	50	0	50	0	0	0	0	0	0	20	20	10	0	0	0	0	0	50	100	50	100
Computer Studies	43	0	43	0	0	0	0	0	0	4	29	10	0	0	0	0	0	43	100	43	100
Principles of Accounts	113	0	113	0	0	0	0	0	0	54	34	15	5	1	4	0	0	103	91.15	103	91.15
Commerce	3	0	3	0	0	0	0	0	0	3	0	0	0	0	0	0	0	3	100	3	100
ECONOMICS	1	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	1	100	1	100
STATISTICS	1	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	100	1	100
ADDITIONAL MATHS	1	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0

2016 "A" Level. Single Sex School.

SUBJECT	NO. OF STUDENTS	A	B	C	D	E	O	F	NO. PASSED	NO. FAILED	% PASSRA
LITERATURE	21	9	6	6	0	0	0	0	21	0	100
DIVINITY	24	8	12	3	1	0	0	0	24	0	100
HISTORY	25	8	11	5	1	0	0	0	25	0	100
GEOGRAPHY	10	1	3	4	2	0	0	0	10	0	100
ECONOMICS	22	4	9	9	0	0	0	0	22	0	100
AGRICULTURE	8	6	1	1	0	0	0	0	8	0	100
MATHS	69	26	17	14	6	3	3	0	66	3	95.65
FURTHER MATHS	3	0	0	1	1	1	0	0	3	0	100
PHYSICS	39	7	18	7	5	1	1	0	38	1	97.44
CHEMISTRY	49	10	13	10	12	3	1	0	48	1	97.96
BIOLOGY	22	8	7	5	1	0	1	0	21	1	95.24
ACCOUNTING	20	5	4	5	1	2	2	1	17	3	85
BUSINESS STUDIES	26	7	14	3	2	0	0	0	26	0	100

TOTAL REGISTERED FOR 2 OR MORE SUBJECTS = 110

TOTAL WITH 2 PASSES OR MORE = 107

% PASSRATE $= \frac{108}{110} \times 100 = 97.27\,\%$

2017 "A Level. Single Sex School

A'LEVEL RESULT ANALYSIS

The following is the analysis of 2017 "A" Level ZIMSEC Results

Subject	No. of students	A	B	C	D	E	O	F	No. of passes	No. of failures	% Pass rate
Literature in English	15	14	1						15		100%
Divinity	17	0	2	5	6	2	1		16		94.1%
History	19	12	4	2	1				19		100%
Geography	21	11	4	3	3				21		100%
Economics	19	0	4	8	3	1	3		16		84.2%
Agriculture	5	0	2	0	1	1	1		4		80%
Maths	60	26	10	14	6	3	1		59		98.3%
Food Science	4	1	0	1	2				4		100%
Physics	29	8	6	7	5	3			29		100%
Chemistry	44	2	20	11	5	5	1		43		97.7%
Biology	22	7	6	4	3	2			22		100%
Accounting	22	7.	5	6	1	1	2		20		90.9%
Business Studies	28	1	8	14	4	1			28		100%

Ranking of Students by number of Points

No. of points	2	3	4	5	6	7	8	9	10	11	12	13	14	15 in 3	17 in 4	18 in 4	19 in 4
No. of students	1	1	4	4	4	1	12	4	9	11	20	10	12	3	1	1	1

Total number of students with 15 points or better = 6

2016 "O" Level. Mixed Sex School.

[redacted]

MINISTRY OF PRIMARY AND SECONDARY EDUCATION
ANALYSIS OF "O" LEVEL EXAMINATION RESULTS 2016

[redacted]

"O" LEVEL	CANDIDATES			MALES						FEMALES						% PASS RATE					
SUBJECT	Total	M	F	A	B	C	D	E	U	A	B	C	D	E	U	M	%	F	%	TOT	%
ENGLISH LANGUAGE	211	112	99	18	33	50	6	2	3	7	47	40	3	2	-	101	91.1	95	95	196	92.9
ENGLISH LITERATURE	120	55	65	4	10	21	6	7	7	7	22	20	9	4	5	35	63.6	49	75.4	84	70.0
HISTORY	211	112	99	58	17	16	4	10	7	43	17	22	9	4	4	91	81.3	82	82.8	173	82.0
GEOGRAPHY	206	108	98	43	31	16	11	3	4	34	35	18	5	4	2	90	83.3	87	88.8	177	85.9
NDEBELE	9	4	5	1	2	-	1	-	-	3	-	1	-	1	-	3	75.0	4	80	7	77.8
SHONA	197	103	94	21	15	27	15	14	11	24	29	23	9	5	4	63	61.2	76	80.9	139	70.5
MATHEMATICS	208	119	99	21	21	24	5	7	31	10	15	25	7	10	32	66	60.6	50	50.5	116	55.8
INTERGRATED SCIENCE	211	112	99	29	31	25	16	8	3	22	30	25	12	8	2	85	75.9	77	77.8	162	76.8
BIOLOGY	42	25	17	1	19	5	-	-	-	3	10	3	1	-	-	25	100	16	94.1	41	97.5
PHYSICS	41	24	17	6	10	3	3	2		4	4	5	[illegible]	-	-	19	79.2	14	82.[illegible]	33	80.5
CHEMISTRY	42	24	18	9	12	3	1	-		2	7	1	1	-	-	23	95.8	17	94.4	40	95.2
COMMERCE	86	59	27	7	13	13	21	4	11	6	9	2	1	1	7	33	55.0	17	63	50	58.1
ACCOUNTS	123	52	71	16	19	13	2	1	1	17	18	21	9	3	3	48	92.3	56	78.9	104	84.6
AGRICULTURE	23	14	10	1	7	2	3	1	-	2	4	3	1	-		10	71.4	9	90.0	19	82.0
FASHION AND FABRICS	24	-	25		-	-		-	-	6	11	8	-	1	-	-		24	96.0	24	96.0
FOODS AND NUTRITION	28	-	28	-	-	-			-	11	12	5		-	-	-	-	28	100	28	100
ART	16	9	7	-	1	3	5	-	-	-	-	4	3	-		4	44.4	4	57.1	8	50.0
TECHNICAL GRAPHICS	27	25	2	2	9	12	3	1	2	-		1	1		-	19	76.0	1	50.0	20	74.1
BUILDING	12	12	-		3	3	4	-	1	-	-			-	-	6	50.0	-	-	6	50.0
MUSIC	17	10	7	2	4	3	1	-	-	-	2	4	-	1	-	9	90.0	6	85.7	15	88.2
WOOD WORK	21	19	2	2	5	9	1	2	-		-	1		1	-	16	84.2	1	50	17	81.0
COMPUTER STUDIES	14	7	7	-	2	5	-	-	-	-	3	3	-	-	-	7	100	6	85.7	13	92.9
RELIGIOS STUDIES	43	27	16	3	3	5	2	2	12	1	3	3	5	-	4	11	40.7	7	43.8	18	41.9

2017 "O" Level. Mixed Sex School.

[redacted]

MINISTRY OF PRIMARY AND SECONDARY EDUCATION
ANALYSIS OF "O" LEVEL EXAMINATION RESULTS 2017

[redacted]

'O' LEVEL SUBJECT	CANDIDATES Total	M	F	MALES A	B	C	D	E	U	FEMALES A	B	C	D	E	U	% PASS RATE M	%	F	%	TOT	%
ENGLISH LANGUAGE	217	95	122	3	31	40	12	3	0	11	67	12	9	1		74	77.9	110	90.2	184	84.8
LITERATURE IN ENGLISH	80	26	54	1	4	12	4	3	2	17	10	10		2		17	65.4	52	96.3	69	86.3
HISTORY	211	95	116	40	20	17	5	2	11	49	27	15	9	6	10	77	81.1	91	78.4	168	79.6
GEOGRAPHY	209	91	118	46	20	17	8	3	2	55	12	23	6	1	1	78	85.7	110	93.2	188	90.0
NDEBELE	2	-	2	.	.	.			.	.		1	.		1		.	1	50.0	1	50.0
SHONA	205	87	118	9	14	22	9	8	26	20	22	35	13	7	21	45	51.7	77	65.3	122	59.5
MATHEMATICS	211	89	122	11	17	23	5	3	30	8	19	24	11	6	54	51	57.3	51	41.8	102	48.3
INTERGRATED SCIENCE	214	93	121	12	15	33	11	10	9	9	27	11	25	14	31	61	67.4	67	55.4	129	60.2
BIOLOGY	46	22	24	2	13	6		1	.	.	8	8	2	1		21	95.5	16	66.7	37	80.4
PHYSICS	47	22	25	1	6	10	2	2	1	.	4	4	6	6	5	17	77.3	8	32.0	25	53.2
CHEMISTRY	47	22	25	4	9	7	1	1	.	2	7	9	4	3	.	20	90.9	18	72.0	38	80.9
COMMERCE	110	40	70	3	10	17	4	1	5	7	13	31	5	5	8	30	75.0	51	72.9	81	73.6
ACCOUNTS	100	50	50	9	8	17	7	4	5	6	19	13	5	3	4	34	68.0	38	76.0	72	72.0
AGRICULTURE	28	16	12	3	6	3	3	.	1	2	4	3	3		.	12	75.0	9	75.0	21	75.0
FASHION AND FABRICS	47		47	.		.		.	.	16	15	14	1	1		.	.	45	95.7	45	95.7
FOODS AND NUTRITION	22	1	21	.	1			-	.	9	11	1			.	1	100	21	100	22	100
ART	17	13	4	3	2	8	.		.	-		1	3			13	100	1	25.0	14	82.4
TECHNICAL GRAPHICS	20	16	4		12	4	.	.	.	.		2	1		.	16	100	3	75.0	19	95.0
BUILDING	10	7	3	-	.	2	1	1	3	.		.			.	2	28.6	0	0	2	20.0
MUSIC	15	7	8	1	1	2	3		.	1	4	1	.	2	1	4	57.1	8	100	12	80.0
WOOD WORK	10	10		.	5	3	1	1	.	.	.	.		.	.	8	80.0	.		8	80.0
COMPUTER STUDIES	29	15	14	.	3	7	5	.	.	.	3	6	5	.	.	10	66.7	9	64.3	19	65.5
RELIGIOUS STUDIES	64	31	33	9	9	3	1	2	7	8	4	10	2		9	21	67.7	22	66.7	43	67.2

2016 "A" Level. Mixed Sex School.

[redacted]

'A' LEVEL RESULTS 2016

SUBJECT					MALES							FEMALES							% PASS RATE		OVER ALL % PASS RATE
		M	F	TOTAL CANDI DATES	A	B	C	D	E	O	F	A	B	C	D	E	O	F	M	F	
SHONA		3	6	9	1	1	0	1	0	0	0	1	2	2	1	0	0	0	100	100	100
LIT IN ENG		6	21	27	0	1	4	1	0	0	0	6	3	9	3	0	0	0	100	100	100
DIVINITY		12	27	39	0	0	5	4	3	0	0	2	7	11	3	3	1	0	100	96.3	97.4
HISTORY		10	26	36	3	1	5	1	0	0	0	0	11	12	3	0	0	0	100	100	100
GEOGRAPHY		23	20	43	10	2	2	4	5	0	0	7	3	3	4	2	1	0	100	95	97.6
ECONOMICS		8	7	15	1	2	3	0	1	1	0	0	1	2	1	1	2	0	87.5	71.4	80.0
ACCOUNTING		17	15	32	1	0	3	1	1	5	6	3	3	2	1	0	4	2	64.7	60.0	46.8
BUSSINESS STUDIES		18	17	35	0	1	6	0	6	0	1	1	1	8	3	1	3	0	100	88.6	88.6
MATHEMATICS		32	14	46	10	4	9	3	4	1	1	0	1	4	4	1	4	0	93.8	71.4	86.9
PHYSICS		23	1	24	5	5	4	2	1	3	2	0	0	0	0	1	0	0	78.3	100	79.2
CHEMISTRY		19	4	23	4	8	3	2	1	2	0	0	0	0	3	0	1	0	94.7	75.0	86.9
BIOLOGY		6	4	10	3	2	1	0	0	0	0	0	1	1	0	1	0	1	100	75.0	90.0
COMPUTING		10	2		3	6	1	0	0	0	0	0	0	1	1	0	0	0	100	100	100
TEXTILES AND CLOTHING DESIGN		-	7	7	0	0	0	0	0	0	0	5	0	2	0	0	0	0	0	100	100

2017 "A" Level. Mixed Sex School.

[redacted]

'A' LEVEL RESULTS 2017

SUBJECT	M	F	TOTAL CANDIDATES	MALES A	MALES B	MALES C	MALES D	MALES E	MALES O	MALES F	FEMALES A	FEMALES B	FEMALES C	FEMALES D	FEMALES E	FEMALES O	FEMALES F	% PASS RATE M	% PASS RATE F	OVERALL % PASS RATE
SHONA	03	08	11	1	0	0	1	1	0	0	0	1	2	4	1	0	0	100	100	100
LIT IN ENG	08	18	26	3	3	2	0	0	0	0	13	2	3	0	0	0	0	100	100	100
DIVINITY	10	13	23	0	1	6	2	1	0	0	2	3	7	1	0	0	0	100	100	100
HISTORY	16	23	39	5	6	4	1	0	0	0	0	11	10	2	0	0	0	100	100	100
GEOGRAPHY	18	23	41	6	4	6	1	0	1	0	9	6	2	4	1	1	0	94.4	95.7	95.1
ECONOMICS	6	6	12	0	1	1	1	0	2	1	1	1	1	1	0	2	0	50	66.7	58.3
ACCOUNTING	5	20	25	0	0	0	0	0	2	3	3	5	1	1	0	5	5	0	50	40.0
BUSSINESS STUDIES	8	22	29	0	3	3	1	1	0	0	3	9	6	1	1	1	0	100	95.2	96.6
MATHEMATICS	33	32	65	7	8	4	4	6	4	0	5	10	7	7	1	2	0	97.9	93.8	90.8
PHYSICS	26	15	31	5	4	7	3	1	1	0	1	2	6	5	1	0	0	93.8	100	96.5
CHEMISTRY	17	19	36	2	4	4	3	1	3	0	1	10	4	2	2	0	0	82.4	100	91.7
BIOLOGY	4	7	11	1	0	0	1	2	0	0	3	1	2	1	0	0	0	100	100	100
COMPUTING	3	3	6	0	0	1	1	1	0	0	0	1	0	1	0	1	0	100	66.6	83.3
TEXTILES AND CLOTHING DESIGN	0	7	7	0	0	0	0	0	0	0	6	0	0	1	0	0	0	100	100	100
FOOD SCIENCE	0	4	4	0	0	0	0	0	0	0	3	0	1	0	0	0	0	100	100	100
GEOMETRICAL & BUILDING DRAWING	4	2	6	4	0	0	0	0	0	0	0	1	1	0	0	0	0	100	100	100

1

APPENDIX 5: CONSENT FORMS FOR PARTICIPANTS

5.1 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR PARENTS ON BEHALF OF MINOR CHILDREN (LEARNERS)

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

I am Herbert Zigara a doctoral of Education student at the University of Venda. I would like to request your child to be part of my study, which is on, "Pedagogic gender sensitivity in the teaching and learning of science and technology: A comparative case study of single and mixed sex high schools in Zimbabwe".

I hope to find more information on the nature of access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools. I also hope to gain some insights into how gender socialisation influences boys' and girls' access to, and their performance in science and technology subjects at single and mixed sex schools.

Purpose of the study

The main objectives of the study include are:

- Establishing if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- Determining if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- Establishing if there is any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at a mixed sex school.

- Exploring factors that could influence access to, and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that knowledge gained may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

The decision to take part in this research study is completely voluntary, that is, everyone is free to refuse to take part in the study if they feel they have doubts or think that their participation could leave them physically, emotionally or psychologically disturbed. If anyone agrees to take part but change his/her mind later, he/she is free to withdraw from the study without being asked to explain themselves.

Risks to the participants

Due to the fact that participants shall only be responding by filling in questionnaires on the subject under study, there are no foreseeable physical injuries that could result from their participation. However, if there are some questions that participants do not want to answer on the questionnaire, they have the right not to answer them.

Privacy and confidentiality of participants

The participants are advised that the research is not about their private life, but about their perceptions and experiences on factors that influence the differences in performance of boys and girls in science and technology subjects. Participants are also expected to shed some insights into how gender socialisation influences boys' and girls' access to, and performance in science and technology subjects at single and mixed sex schools. All the views gathered in the research will be handled in a strictly private and confidential manner. No names from the participants will be needed. Gathered information will only be used for this research and will not be disclosed to any unauthorised people.

Administration of the questionnaire

If your child accepts to take part in the research study, I request him/her to complete a given questionnaire by filling in the blank spaces. His/her responses will be treated with strict confidentiality and will be used solely for this study and not for any other purpose. He/she will not be asked to write his/her name. Participants are kindly asked to answer all questions to the best of their knowledge. However, if there are some questions that participants do not want to answer on the questionnaire or during the interview, they have the right not to answer them.

Approval from authorities

Written permission to conduct this research was granted by the Permanent Secretary of the Ministry of Primary and Secondary Education, Provincial Education Directors (PEDs), District Education Directors (DEDs) and headmasters in Zimbabwe. However, this does not mean that participants are forced to take part against their will. If you have any queries about the information sheet, please feel free to contact me or my promoters.

(1) Herbert Zigara
Cell number: +2773 738 2719
Email address: runganozigara@gmail.com
(2) Prof. Tawanda Runhare (Promoter)
Telephone number: 015 962 9094
Email: tawanda.runhare@univen.ac.za
(3) Dr Ndanganeni Florence Litshani (Co-Promoter)
Cell number: +015 9629114
Email: Ndanganeni.Litshani@univen.ac.za

Kind regards
H. Zigara

INFORMED CONSENT DECLARATION

In terms of the ethical requirements of the Research Ethics of the University of Venda, I now invite you to complete this form as an indication of your permission to voluntarily allow your child to participate in this research project.

I hereby confirm that I have been fully informed about the purpose, procedures, and activities of the research project. The right of participants have also been fully explained to me. I was given full opportunity to ask questions and I understand that participants can withdraw from the project at any stage and time, without giving any reason.

I, therefore, hereby freely **give** my consent for my child to voluntarily take part in the project as outlined.

Tick

I, therefore, hereby freely **do not give** my consent for my child to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature ______ **Date: ....**

5.2 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR LEARNERS

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

I am Herbert Zigara, a Doctor of Education (DED) student at the University of Venda. I would like to request your child to be part of my study, which is on, "Pedagogic gender sensitivity in the teaching and learning of science and technology: A comparative case study of single and mixed sex high schools in Zimbabwe".

I hope to find more information on the nature of access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools. I also hope to gain some insights on how gender socialisation influences boys' and girls' access to, and their performance in science and technology subjects at single and mixed sex schools.

Purpose of the research study

The main objectives of the research study include:

- Establishing if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- Determining if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- Establishing if there is any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at

a mixed sex school.

- Exploring factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that knowledge gained from this research may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

The decision to take part in this study is completely voluntary, that is, everyone is free to refuse to take part in the research study if they feel they have doubts or think that their participation could leave them physically, emotionally or psychologically disturbed. If anyone agrees to take part but change his/her mind later, he/she is free to withdraw from the research study without being asked to explain themselves.

Risks to the participants

Due to the fact that participants shall only be responding by filling in questionnaires on the subject under study, there are no foreseeable physical injuries that could result from their participation. However, if there are some questions that participants do not want to answer on the questionnaire, they have the right not to answer them.

Privacy and confidentiality of participants

The participants are advised that the research is not about their private life but about their perceptions and experiences on factors that influence the differences in performance of boys and girls in science and technology subjects. Participants are also expected to shed some insights on how gender socialisation influences boys' and girls' access to, and performance in science and technology subjects at single and mixed sex schools. All the views gathered in the research study will be handled in a strictly private and confidential manner. No names from the participants will be needed. Gathered information will only be used for this research study and will not be disclosed to any unauthorised people.

Administration of the questionnaire

If you accept to take part in the research study, I request your permission to complete a given questionnaire by filling in the blank spaces. Your responses will be treated with strict confidentiality and will be used solely for this study and not for any other purpose. You will not be asked to write your name. Participants are kindly asked to answer all questions to the best of their knowledge. However, if there are some questions that participants do not want to answer on the questionnaire or during the interview, they have the right not to answer them.

Approval from authorities

Written permission to conduct this research study was granted by the Permanent Secretary of the Ministry of Primary and Secondary Education, Provincial Education Directors (PEDs), District Education Directors (DEDs) and headmasters in Zimbabwe. However, this does not mean that participants are forced to take part against their will. If you have any queries about the information sheet, please feel free to contact me or my promoters.

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Kind regards
H. Zigara

INFORMED CONSENT DECLARATION

In terms of the ethical requirements of the Research Ethics of the University of Venda, I now invite you to complete this form as an indication of your permission to voluntarily participate in this research project.

I hereby confirm that I have been fully informed about the purpose, procedures, and activities of the research project. The right of participants have also been fully explained to me. I was given full opportunity to ask questions and I understand that participants can withdraw from the project at any stage and time, without giving any reason.

I, therefore, hereby freely **give** my consent to voluntarily take part in the project as outlined.

Tick

I, therefore, hereby freely **do not give** my consent to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature  **Date: ....**

5.3 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR HEADMASTERS

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

I am Herbert Zigara a Doctor of Education (DED) student at the University of Venda. I would like to request you to be part of my research study, which is on, “Pedagogic gender sensitivity in the teaching and learning of science and technology: A comparative case study of single and mixed sex high schools in Zimbabwe”.

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- Establishing if there is any significant difference in access to and performance

in science and technology subjects between girls at a single sex and boys at a mixed sex school.

- Exploring factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that knowledge gained from this research may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

The decision to take part in this research study is completely voluntary, that is, everyone is free to refuse to take part in the research study if they feel they have doubts or think that their participation could leave them physically, emotionally or psychologically disturbed. If anyone agrees to take part but change his/her mind later, he/she is free to withdraw from the research study without being asked to explain themselves.

Risks to the participants

Due to the fact that participants shall only be answering interview questions on the subject under study, there are no foreseeable physical injuries that could result from their participation. However, if there are some questions that participants do not want to answer during the interview, they have the right not to answer them.

Privacy and confidentiality of participants

The participants are advised that the research is not about their private life, but about their views and experience on factors that influence the differences in performance of boys and girls in science and technology subjects. Participants are also expected to shed some insights into how gender socialisation influences boys' and girls' access to, and performance in science and technology subjects at single and mixed sex schools. All the views gathered in the research study will be handled in a strictly private and confidential manner. No names from the participants will be needed. Gathered information will only be used for this research study and will not be disclosed to any unauthorised people.

Interview process

If you accept to take part in the research study, I request your permission to audio record the interview. This will help me to listen to the interview again at a later stage, and if I need the assistance of a second person in a form of a transcriber, then that person can also listen to the recorded interview, however, transcribers are also not allowed to share the information he/she listened to, to anyone. The audio recordings and the transcripts will be kept in a safe place. The final report shall be available to the participants before being accessed by the public through the University of Venda.

Approval from authorities

Written permission to conduct this research study was granted by the Permanent Secretary of the Ministry of Primary and Secondary Education, Provincial Education Directors (PEDs) and District Education Directors (DEDs) in Zimbabwe. However, this does not mean that participants are forced to take part against their will. If you have any queries about the information sheet, please feel free to contact me or my promoters.

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I, therefore, hereby freely **give** my consent to voluntarily take part in the project as outlined.

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I, therefore, hereby freely **do not give** my consent to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature **Date: ………………………………..**

5.4 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR DEPUTY HEADS

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

I am Herbert Zigara, a Doctor of Education (DED) student at the University of Venda. I would like to request you to be part of my research, which is on, "Pedagogic gender sensitivity in the teaching and learning of science and technology: A comparative case study of single and mixed sex high schools in Zimbabwe".

I hope to find more information on the nature of access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools. I also hope to gain some insights on how gender socialisation influences boys' and girls' access to, and their performance in science and technology subjects at single and mixed sex schools.

Purpose of the research study

The main objectives of the research study include:

- Establishing if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- Determining if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- Establishing if there is any significant difference in access to and performance in science and technology subjects between girls at a single sex and boys at

a mixed sex school.

- Exploring factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that knowledge gained through this study may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

The decision to take part in this research study is completely voluntary, that is, everyone is free to refuse to take part in the research study if they feel they have doubts or think that their participation could leave them physically, emotionally or psychologically disturbed. If anyone agrees to take part but change his/her mind later, he/she is free to withdraw from the research study without being asked to explain themselves.

Risks to the participants

Due to the fact that participants shall only be answering interview questions on the subject under study, there are no foreseeable physical injuries that could result from their participation. However, if there are some questions that participants do not want to answer during the interview, they have the right not to answer them.

Privacy and confidentiality of participants

The participants are advised that the study is not about their private life but about their views and experience on factors that influence the differences in performance of boys and girls in science and technology subjects. Participants are also expected to shed some insights on how gender socialisation influences boys' and girls' access to, and performance in science and technology subjects at single and mixed sex schools. All the views gathered in the research study will be handled in a strictly private and confidential manner. No names from the participants will be needed.

Gathered information will only be used for this research study and will not be disclosed to any unauthorised people.

Interview process

If you accept to take part in the study, I request your permission to audio record the interview. This will help me to listen to the interview again at a later stage, and if I need the assistance of a second person in a form of a transcriber, then that person can also listen to the recorded interview, however, transcribers are also not allowed to share the information he/she listened to, to anyone. The audio recordings and the transcripts will be kept in a safe place. The final report shall be available to the participants before being accessed by the public through the University of Venda.

Approval from authorities

Written permission to conduct this study was granted by the Permanent Secretary of the Ministry of Primary and Secondary Education, Provincial Education Directors (PEDs), District Education Directors (DEDs) and headmasters in Zimbabwe. However, this does not mean that participants are forced to take part against their will. If you have any queries about the information sheet, please feel free to contact me or my promoters.

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Cell number: +015 9629114
Email: Ndanganeni.Litshani@univen.ac.za

Kind regards
H. Zigara

INFORMED CONSENT DECLARATION

In terms of the ethical requirements of the Research Ethics of the University of Venda, I now invite you to complete this form as an indication of your permission to voluntarily participate in this research project.

I hereby confirm that I have been fully informed about the purpose, procedures, and activities of the research project. The right of participants have also been fully explained to me. I was given full opportunity to ask questions and I understand that participants can withdraw from the project at any stage and time, without giving any reason.

I, therefore, hereby freely **give** my consent to voluntarily take part in the project as outlined.

Tick

I, therefore, hereby freely **do not give** my consent to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature ______ **Date: ……………………………….**

5.5 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR HODs

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

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I hope to find more information on the nature of access to and performance in science and technology subjects by boys and girls at single sex and mixed sex schools. I also hope to gain some insights on how gender socialisation influences boys' and girls' access to, and their performance in science and technology subjects at single and mixed sex schools.

Purpose of the research study

The main objectives of the research study include:

- Establishing if there is any significant difference in access and performance of girls in science and technology subjects at a single sex and a mixed sex school.
- Determining if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.
- Establishing if there is any significant difference in access to and performance

in science and technology subjects between girls at a single sex and boys at a mixed sex school.

- Exploring factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that gained knowledge may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

The decision to take part in this study is completely voluntary, that is, everyone is free to refuse to take part in the research study if they feel they have doubts or think that their participation could leave them physically, emotionally or psychologically disturbed. If anyone agrees to take part but change his/her mind later, he/she is free to withdraw from the research study without being asked to explain themselves.

Risks to the participants

Due to the fact that participants shall only be answering interview questions on the subject under study, there are no foreseeable physical injuries that could result from their participation. However, if there are some questions that participants do not want to answer during the interview, they have the right not to answer them.

Privacy and confidentiality of participants

The participants are advised that the research study is not about their private life but about their views and experience on factors that influence the differences in performance of boys and girls in science and technology subjects. Participants are also expected to shed some insights on how gender socialisation influences boys' and girls' access to, and performance in science and technology subjects at single and mixed sex schools. All the views gathered in the research study will be handled in a strictly private and confidential manner. No names from the participants will be needed. Gathered information will only be used for this research study and will not be disclosed to any unauthorised people.

Interview process

If you accept to take part in the study, I request your permission to audio record the interview. This will help me to listen to the interview again at a later stage, and if I need the assistance of a second person in a form of a transcriber, then that person can also listen to the recorded interview, however, transcribers are also not allowed to share the information he/she listened to, to anyone. The audio recordings and the transcripts will be kept in a safe place. The final report shall be available to the participants before being accessed by the public through the University of Venda.

Administration of the questionnaire

If you accept to take part in the research, I request your permission to complete a given questionnaire by filling in the blank spaces. Your responses will be treated with strict confidentiality and will be used solely for this study and not for any other purpose. You will not be asked to write your name. Participants are kindly asked to answer all questions to the best of their knowledge. However, if there are some questions that participants do not want to answer on the questionnaire or during the interview, they have the right not to answer them.

Approval from authorities

Written permission to conduct this research study was granted by the Permanent Secretary of the Ministry of Primary and Secondary Education, Provincial Education Directors (PEDs), District Education Directors (DEDs) and headmasters in Zimbabwe. However, this does not mean that participants are forced to take part against their will.

If you have any queries about the information sheet, please feel free to contact me or my promoters.

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Kind regards

H. Zigara

INFORMED CONSENT DECLARATION

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I hereby confirm that I have been fully informed about the purpose, procedures, and activities of the research project. The right of participants have also been fully explained to me. I was given full opportunity to ask questions and I understand that participants can withdraw from the project at any stage and time, without giving any reason.

I, therefore, hereby freely **give** my consent to voluntarily take part in the project as outlined.

Tick

I, therefore, hereby freely **do not give** my consent to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature ______________ **Date: ………………………………..**

5.6 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR CLASS TEACHERS

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

Introduction

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Purpose of the research study

The main objectives of the research study include:

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- Determining if there is any significant difference in access to and performance in science and technology subjects for boys and girls at a mixed sex school.

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in science and technology subjects between girls at a single sex and boys at a mixed sex school.

- Exploring factors that could influence access to and performance of boys and girls in science and technology subjects at a single sex and a mixed sex school.

It is believed that knowledge gained from this study may help to promote gender equality in terms of access to, and performance in science and technology subjects as well as in many aspects of social life.

Participant's rights

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Risks to the participants

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Privacy and confidentiality of participants

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Interview process

If you accept to take part in the study, I request your permission to audio record the interview. This will help me to listen to the interview again at a later stage, and if I need the assistance of the second person in a form of a transcriber, then that person can also listen to the recorded interview, however, transcribers are also not allowed to share the information he/she listened to, to anyone. The audio recordings and the transcripts will be kept in a safe place. The final report shall be available to the participants before being accessed by the public through the University of Venda.

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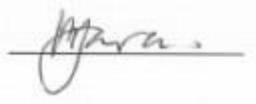
Researcher's Name: Herbert Zigara

Signature  **Date: ……………………………….**

5.7 INFORMATION SHEET AND INFORMED CONSENT DECLARATION FOR SUBJECT TEACHERS

RESEARCH PROJECT ON PEDAGOGIC GENDER SENSITIVITY IN THE TEACHING AND LEARNING OF SCIENCE AND TECHNOLOGY: A COMPARATIVE CASE STUDY OF SINGLE AND MIXED SEX HIGH SCHOOLS IN ZIMBABWE.

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I, therefore, hereby freely **give** my consent to voluntarily take part in the project as outlined.

Tick

I, therefore, hereby freely **do not give** my consent to voluntarily take part in the project as outlined.

Tick

Researcher's Name: Herbert Zigara

Signature ____________ **Date: ………………………………..**

APPENDIX 6: QUESTIONNAIRE GUIDE FOR LEARNERS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions by marking with an 'x' in the spaces provided. You are assured that the information you will provide in this questionnaire schedule will be confidential. It will not be disclosed to anyone but will be solely for this study and not any other purpose. Do not write your names, names of your colleagues or that of your school.

PART ONE: BIOGRAPHICAL INFORMATION

1. Sex: (A) Male ☐ (B) Female ☐
2. Age
   (A) Below 14 years ☐
   (B) 14-16 years ☐
   (C) 16-18 years ☐
   (D) 18-20 years ☐
   (E) Above 20 years ☐

PART TWO: ACCESS AND PERFORMANCE QUESTIONS IN SCIENCE AND TECHNOLOGY SUBJECTS

3. **Answer questions 3.1 to 3.18 on the Likert Scale below by marking with an 'x' in the spaces provided**

Item	Statement	Positive Responses		Negative Responses	
		SA	A	DA	SDA
3.1	My parents give me work to do at home basing on whether I am a boy or girl.				
3.2	I discuss the subjects I study at school with my parents.				
3.3	Of the subjects offered at our school, my parents have told me to study some and leave others.				
3.4	My parents encourage me to study science and technology subjects.				
3.5	My parents choose the job I would like to do in future.				
3.6	Teachers at this school advise us to do different subjects according to whether we are boys or girls.				
3.7	Teachers at our school help us to choose our future jobs according to whether we are boys or girls.				
3.8	Science and technology related careers/jobs are best suited for boys than girls.				
3.9	Given an opportunity, I will study science and technology subjects.				
3.10	Our teachers make efforts to ensure that all boys and girls have equal chance to study science and technology subjects.				
3.11	There are science and technology subjects that I wanted to study but are not taught at this school.				
3.12	Parents' attitudes and expectations at home can influence boys and girls to perform differently at school in science and technology subjects.				
3.13	Jobs/tasks that teachers expect boys and girls to do affect their performance in science and technology subjects.				
3.14	Boys perform better than girls in science and technology subjects.				
3.15	There are some subjects which boys are expected to perform better than girls at school.				
3.16	Performance in science and technology subjects has nothing to do with whether someone is a boy or girl.				
3.17	The family, friends, media and the school environment influence boys and girls to perform differently in science and technology subjects.				
3.18	The performance of mixed sex school girls is the same as that of their single sex school counterparts in science and technology subjects.				

Key: SA = Strongly Agree, A = Agree, DA = Disagree, SDA = Strongly Disagree

APPENDIX 7: INTERVIEW SCHEDULES FOR TEACHERS

7.1 FACE TO FACE INTERVIEW SCHEDULE WITH SCHOOL HEADMASTERS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions in any language that will help you to express your views without compromise. You are assured that everything you will say during the interview will only be used for this project and all the responses you will give will be treated with strict confidentiality. Do not disclose your name or that of your school.

PART ONE: BIOGRAPHICAL QUESTIONS

1 How long have you been the headmaster of this school?
2 Have you ever been staff developed on gender issues in education?

PART TWO: THE INFLUENCE OF GENDER SOCIALISATION ON BOYS' AND GIRLS' ACCESS TO SCIENCE AND TECHNOLOGY SUBJECTS

3 Do you think that there are some subjects best suited for boys and others best suited for girls? Explain your answer.
4 What science and technology subjects are offered at your school? Of these, which do you find offered more to boys?
5 In your view, does the home influence boys and girls to choose different subjects at school?
6 How do schools'/teachers' attitudes and expectations towards boys and girls influence their choice of subjects?
7 What does your school do to give boys and girls equal chances to study science and technology subjects?

8 Do you agree that socialising agents such as the family, peer group, media and education influence boys and girls to pursue different subjects at school? Explain your answer.

9 Do you treat boys and girls differently when giving advice on career choices?

10 Do you give different tasks to boys and girls at this school? If so, can you give me examples of the tasks?

PART THREE: FACTORS THAT COULD INFLUENCE THE DIFFERENCES IN PERFORMANCE OF BOYS AND GIRLS IN SCIENCE AND TECHNOLOGY SUBJECTS

11 Do you agree that the home can influence boys and girls to perform differently in science and technology subjects at school? Can you explain how that happens?

12 How is the performance of boys compared to girls in science and technology subjects at this school?

13 What do you think influences boys and girls to perform differently in science and technology subjects?

14 How do teachers' or schools' attitudes and expectations towards boys and girls influence their performance in science and technology subjects?

15 What is your view on the argument that socialising agents such as the family, peer group, media and education influence boys and girls to perform differently in science and technology subjects?

7.2 FACE TO FACE INTERVIEW SCHEDULE WITH DEPUTY HEADS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions in any language that will help you to express your views without compromise. You are assured that everything you will say during the interview will only be used for this project and all the responses you will give will be treated with strict confidentiality. Do not disclose your name or that of your school.

PART ONE: BIOGRAPHICAL QUESTIONS

1. How long have you been the Deputy Headmaster of this school?
2. Have you ever been staff developed on gender issues in education?

PART TWO: THE INFLUENCE OF GENDER SOCIALISATION ON BOYS' AND GIRLS' ACCESS TO SCIENCE AND TECHNOLOGY SUBJECTS

1. Do you think that there are some subjects best suited for boys and others best suited for girls? Explain your answer.
2. What science and technology subjects are offered at your school? Of these, which do you find offered more to boys?
3. In your view, does the home influence boys and girls to choose different subjects at school?
4. How do schools'/teachers' attitudes and expectations towards boys and girls influence their choice of subjects?
5. What does your school do to give boys and girls equal chances to study science and technology subjects?
6. Do you agree that socialising agents such as the family, peer group, media and education influence boys and girls to pursue different subjects at school?

Explain your answer.

7. Do you treat boys and girls differently when giving advice on career choices?
8. Do you give different tasks to boys and girls at this school? If so, can you give me examples of the tasks?

PART THREE: FACTORS THAT COULD INFLUENCE THE DIFFERENCES IN PERFORMANCE OF BOYS AND GIRLS IN SCIENCE AND TECHNOLOGY SUBJECTS

9. Do you agree that the home can influence boys and girls to perform differently in science and technology subjects at school? Can you explain how that happens?
10. How is the performance of boys compared to girls in science and technology subjects at this school?
11. What do you think influences boys and girls to perform differently in science and technology subjects?
12. How do teachers' or schools' attitudes and expectations towards boys and girls influence their performance in science and technology subjects?
13. What is your view on the argument that socialising agents such as the family, peer group, media and education influence boys and girls to perform differently in science and technology subjects?

7.3 FACE TO FACE INTERVIEW SCHEDULE WITH HEADS OF DEPARTMENTS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions in any language that will help you to express your views without compromise. You are assured that everything you will say during the interview will only be used for this project and all the responses you will give will be treated with strict confidentiality. Do not disclose your name or that of your school.

PART ONE: BIOGRAPHICAL QUESTIONS

1. How long have you been the HOD of this school?
2. Have you ever been staff developed on gender issues in education?

PART TWO: THE INFLUENCE OF GENDER SOCIALISATION ON BOYS' AND GIRLS' ACCESS TO SCIENCE AND TECHNOLOGY SUBJECTS

1. Do you think that there are some subjects best suited for boys and others best suited for girls? Explain your answer.
2. What science and technology subjects are offered at your school? Of these, which do you find offered more to boys?
3. Can the home influence boys and girls to choose different subjects at school? Can you explain how that happens?
4. Does your school influence boys and girls to do different subjects?
5. How do you afford boys and girls equal chances to choose or study science and technology subjects at this school?
6. Do you agree that socialising agents such as the family, peer group, media and education influence boys and girls to pursue different subjects at school?

Explain your answer.

7. Do you treat boys and girls differently when giving advice on career choices?
8. Do you give different tasks to boys and girls at this school? If so, can you give me examples of the tasks?

PART THREE: FACTORS THAT COULD INFLUENCE THE DIFFERENCES IN PERFORMANCE OF BOYS AND GIRLS IN SCIENCE AND TECHNOLOGY SUBJECTS

9. Do you agree that the home can influence boys and girls to perform differently in science and technology subjects at school? Can you explain how that happens?
10. How is the performance of boys compared to girls in science and technology subjects at this school?
11. What do you think influences boys and girls to perform differently in science and technology subjects?
12. How do teachers' or schools' attitudes and expectations towards boys and girls influence their performance in science and technology subjects?
13. What is your view on the argument that socialising agents such as the family, peer group, media and education influence boys and girls to perform differently in science and technology subjects?

7.4 FACE TO FACE INTERVIEW SCHEDULE WITH CLASS TEACHERS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions in any language that will help you to express your views without compromise. You are assured that everything you will say during the interview will only be used for this project and all the responses you will give will be treated with strict confidentiality. Do not disclose your name or that of your school.

PART ONE: BIOGRAPHICAL QUESTIONS

1. How long have you been the Head of Department at this school?
2. Have you ever been staff developed on gender issues in education?

PART TWO: THE INFLUENCE OF GENDER SOCIALISATION ON BOYS' AND GIRLS' ACCESS TO SCIENCE AND TECHNOLOGY SUBJECTS

1. Do you think that there are some subjects best suited for boys and others best suited for girls? Explain your answer.
2. What science and technology subjects are offered at your school? Of these, which do you find offered more to boys?
3. In your view, does the home influence boys and girls to choose different subjects at school?
4. How do schools'/teachers' attitudes and expectations towards boys and girls influence their choice of subjects?
5. What do you do to ensure boys and girls have equal chances to study science and technology subject?
6. Do you agree that socialising agents such as the family, peer group, media and education influence boys and girls to pursue different subjects at school?

Explain your answer.

7. Do you treat boys and girls differently when giving advice on career choices?
8. Do you give different tasks to boys and girls at this school? If so, can you give me examples of the tasks?

PART THREE: FACTORS THAT COULD INFLUENCE THE DIFFERENCES IN PERFORMANCE OF BOYS AND GIRLS IN SCIENCE AND TECHNOLOGY SUBJECTS.

9. Do you agree that the home can influence boys and girls to perform differently in science and technology subjects at school? Can you explain how that happens?
10. How is the performance of boys compared to girls in science and technology subjects at this school?
11. What do you think influences boys and girls to perform differently in science and technology subjects?
12. How do teachers' or schools' attitudes and expectations towards boys and girls influence their performance in science and technology subjects?
13. What is your view on the argument that socialising agents such as the family, peer group, media and education influence boys and girls to perform differently in science and technology subjects?

7.5 FACE TO FACE INTERVIEW SCHEDULE WITH SUBJECT TEACHERS

INTRODUCTION

I wish to thank you for accepting to take part in this research project on gender. Please feel free to answer all questions in any language that will help you to express your views without compromise. You are assured that everything you will say during the interview will only be used for this project and all the responses you will give will be treated with strict confidentiality. Do not disclose your name or that of your school.

PART ONE: BIOGRAPHICAL QUESTIONS

1. How long have you been the subject teacher at this school?
2. Have you ever been staff developed on gender issues in education?

PART TWO: THE INFLUENCE OF GENDER SOCIALISATION ON BOYS' AND GIRLS' ACCESS TO SCIENCE AND TECHNOLOGY SUBJECTS

1. Do you think that there are some subjects best suited for boys and others best suited for girls? Explain your answer.
2. What science and technology subjects are offered at your school? Of these, which do you find offered more to boys?
3. In your view, does the home influence boys and girls to choose different subjects at school?
4. How do schools'/teachers' attitudes and expectations towards boys and girls influence their choice of subjects?
5. What do you do to ensure boys and girls have equal chances to study science and technology subjects?
6. Do you agree that socialising agents such as the family, peer group, media and education influence boys and girls to pursue different subjects at school?

Explain your answer.

7. Do you treat boys and girls differently when giving advice on career choices?
8. Do you give different tasks to boys and girls at this school? If so, can you give me examples of the tasks?

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13. What is your view on the argument that socialising agents such as the family, peer group, media and education influence boys and girls to perform differently in science and technology subjects?

APPENDIX I: EDITOR'S LETTER

University of Venda

Department of Communication and Applied Language

Studies, School of Human and Social Sciences

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TEL: +27159628214/Fax +27159624749

25 March 2020

TO WHOM IT MAY CONCERN

RE: EDITING OF HERBERT ZIGARA'S DOCTOR OF EDUCATION THESIS (STUDENT NUMBER 16023531)

This letter serves to confirm that I edited **HERBERT ZIGARA's** Doctor of Education (DED) Thesis titled, "*Pedagogic Gender Sensitivity in The Teaching and Learning of Science and Technology: A Comparative Case Study of Single and Mixed Sex High Schools in Zimbabwe*"

My work entailed identifying and correcting grammatical, typographical, formatting and related editorial errors in the document.

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I have recommended numerous corrections related to formatting, grammatical, typographical and sentence construction errors in the document. The responsibility to ensure that ALL **the** recommended changes are correctly effected is that of the author of the document.

Should there be any queries regarding the editorial aspects of the document please do not hesitate to contact me.

Yours sincerely

Dr T. Chari, (PhD Wits), Senior Lecturer, Department of Communication & Applied Language. Studies
Cell:
i+27838626747