

**IMPACT OF UGANDA GOVERNMENT SCIENCE-BASED  
UNIVERSITY SPONSORSHIP POLICY ON GIRLS'  
PARTICIPATION IN THE SCIENCES AT A-LEVEL IN  
MUKONO AND WAKISO DISTRICTS**

**ELIZABETH OPIT**

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THE AWARD OF DEGREE OF DOCTOR OF PHILOSOPHY  
OF EDUCATION-KENYATTA UNIVERSITY**

**JUNE, 2014**

**DECLARATION**

I confirm that this research project/thesis is my original work and has not been presented in any other university/institution for certification. The thesis has been complemented by referenced works duly acknowledged. Where text, data, graphics, pictures or tables have been borrowed from other works- including the internet, the sources are specifically accredited through referencing in accordance with anti-plagiarism regulations.

**Signature**\_\_\_\_\_ **Date**\_\_\_\_\_

Opit Elizabeth

E83/10566/2007

We/I confirm that the work reported in this project/thesis was carried out by the candidate under my/our supervision as University supervisor(s).

**Signature**\_\_\_\_\_ **Date**\_\_\_\_\_

Professor Daniel N. Sifuna

Department of Educational Foundations

**Signature**\_\_\_\_\_ **Date**\_\_\_\_\_

Professor Chege Fatuma

Department of Educational Foundations

### **DEDICATION**

I dedicate this work to: my late parents, William Opit and Lois Opit, who sacrificially and dedicatedly funded my Pre-primary, Primary and Secondary School education without which I wouldn't have had the opportunity to do this thesis; and my siblings Michael, George, Susan, David, Andrew and Joseph for giving me the encouragement and material support I needed to complete this work.

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**ABBREVIATIONS AND ACRONYMS**

AA	Affirmative Action
AAP	Affirmative Action Policy
AAUW	American Association for University Women
CEC	Commission of the European Communities
CEF	Commonwealth Education Fund
EPS	Equal Probability Selection
EU	European Union
FAO	Food and Agricultural Organisation
FAWE	Forum for African Women Educationists
FAWEU	Forum for African Women Educationists-Uganda
FEMSA	Female Education in Mathematics and Science in Africa
FSI	Female Scholarship Initiative
GCE	Ghana Certificate Examinations
GEF/UNEP	United Nations Environment Programme under the Global Environmental Facility
GESET	Girls Exploring Science, Engineering & Technology
GTS	Gender, Technology & Science
HRID	Human Resource and Institutional Development
ICT	Information and Communication Technology
MDG	Millennium Development Goals
MoES	Ministry of Education and Sports
MTS	Mathematics, Technology and Science
NGOs	Non-Government Organizations

NSF	National Science Foundation
OECD	Organization for Economic Cooperation and development
OFTS	Oklahoma Future Teacher Scholarship recipients
PISA	Programme for International Students Assessment
PMG	Parliamentary Monitoring Group
PUJAB	Public Universities Joint Admissions Board
SAT	Scholastic Aptitude Test
SME	Science, Math and Engineering
SPSS	Statistical Package for Social Scientists
STEM	Science Technology, Engineering and Mathematics
STEPS	Science, Technology, Engineering, Preview Summit
STEPSC	Science, Technology and Engineering Preview Summer camps
STM	Science, Technology and Mathematics Subjects
STME	Science Technology, Maths and Engineering
SWE	Society of Women Educationists
UACE	Uganda Advanced Certificate Examinations
UBOS	Uganda Board of Statistics
UDSM	University of Dar-es-Salaam
UGSBUSP	Uganda Government Science-Based University Sponsorship Policy
UNDP	United Nations Development Programme
UNEB	Uganda National Examinations Board
UNEB	Uganda National Examinations Board

## ABSTRACT

This study focuses on the impact of the Uganda government Science-Based University Sponsorship Policy on girl's participation in sciences at A-level in Mukono and Wakiso District. The study addressed four objective: the first objective aimed at comparing enrolment of girls and boys in the sciences at A-level before and after the inception of the policy; the second objective was to establish the relationship between girls' awareness of the policy and their choice to enroll for sciences at A-level compared to the boys; the third objective sought to compare the performance of girls and boys in the sciences at A-level before and after the inception of the policy and the fourth objective was to establish the relationship between girls' awareness of the policy and their performance in the sciences at A-level compared with that of the boys. The study employed an Ex-Post-Facto design that used quantitative and qualitative methods to elicit data from the study sample. Purposive, stratified and simple random sampling techniques were used to select study participants from six secondary school in the two districts of Central Uganda. Responses were obtained from a total of 292 participants who included: 216 students (112 and 104 boys), 40 parent (23 mothers and 17 fathers), 14 science teachers (5 females and 9 males), 06 directors of studies (01 female and 5 males), 06 career teachers (2 females and 04 males), 6 head teachers (2 females and 4 males), 02 male district inspectors of schools and 02 Ministry of Education and Sports official (01 male and 01 female). Data was collected by use of questionnaires, individual interview guides and a focus group discussion interview guide. Pearson r and T-tests were used to analyze qualitative data, while descriptive and thematic methods were used for analyzing qualitative data generated from individual and focus group discussion interviews. The study revealed that, even after the inception of the Uganda GSBUSP, there are disparities in students' participation in the sciences at A-Level in favour of the boys. While there is no significant correlation between girls' awareness of the policy and choice to enroll, for the science at A-level, it was significant for the boys. For both genders, there was no significant correlation between awareness of the policy and performance in science. These results indicate that, overall, the policy favours boys' participation in sciences at A-level compared to girls. It is recommended that the policy needs to be revised to become sensitive to girls' needs if it is to significantly attract more girls into sciences. For instance the government should consider ;articulating a specific number of slots for girls in its science-based University sponsorship, broadening the sponsorship package to include funding of; remedial courses for unsuccessful borderline female University candidates and mentoring sessions for girls who need additional support in the sciences at university. The policy should be implemented alongside other science-based sponsoring policies and interventions that pro-actively promote girls' participation in the sciences.

## **CHAPTER ONE**

### **1.1 Introduction**

This study is a search for an in-depth understanding of the impact of Uganda Government Science-Based University Sponsorship Policy (UGSBUSP) on girls' participation in the sciences at A- level. In this chapter, the researcher focuses on the background to the study in relation to the use of science based sponsorship to increase girls' participation in sciences, statement of the problem, purpose, objectives, research hypotheses, and significance of the study. The chapter further highlights the study's limitations and delimitations, theoretical and conceptual framework and operational definition of terms used in the study.

### **1.2 Background to the Problem**

Women's access to science and technology spurs national economic growth and enables them to create, receive, share and use information and knowledge for their cultural and political development (Ainuddin, Carvalho, Fan, Kelar, Munder & Taeb, 2005). Girls' access to science education achieves greater earning abilities for families, reduces infant mortality and improves public health levels (UNIDO, 2001). Additionally, women's participation in sciences improves their quality of life, literacy and life expectancy, while decreasing their fertility rate (UNIDO, 2001). Therefore, the pivotal role of women's participation in science and technology cannot be over-emphasized in national development (Kalesanwo & Bilesanmi-Awonderu, 2009; Harmawati & Luthulima, 2000). Failing to train and utilize the potentials of women in the sciences is detrimental to the economies of societies at macro and micro

levels(Jochimsen, 2007).According to Ainuddin, et al (2005) it is necessary to recognize that the participation of women in science and technology is no longer simply an issue of gender equity but a national economic development concern.

Different research studies in various countries have documented gender enrolment inequalities against female students in Science, Technology and Mathematics (STM) as compared to that of males. Some of these countries include Britain (British Parliament, 2009); Japan (Maira, 2006); United States (Society of Women Engineers [SWE], 2004); MacDonald, 2002); Francophone-Africa (Assie-Lumumba, 1993 cited in Rathgeber, 2003); Tanzania (Masanja, 2001); Nigeria (Onokala & Onwurah, 2001); Ghana (Sutherland-Addy, 2002); Kenya (Bunyi, 2009; Gender, Science & Technology [GST] Gateway, 2004), and Uganda (Kwesiga, 2002).Studies in the above-mentioned countries and other studies have identified several factors that constrain women's choice to enrol in science. The major constraints include socio-cultural beliefs and practices (Asimwe, 2008; Miura, 2007); unfriendly formal education environments (Bunyi, 2009); and insufficient role models (Lynch & Feeley, 2009; Kwesiga, 2002; Mulemwa, 1997). Therefore, the understanding of the influence of the Uganda Government Science-Based University Sponsorship Policy (GSBUSP) on girls' choice to enrol in the sciences at A-level cannot be stated outside the historical context of gender equity in the science field.

In Uganda, formal education was introduced by missionaries (Sekamwa, 2000). The cardinal objective of the missionaries' education was to make their converts literate in the bible and other simple Christian issues but not so much in science (Wandira, 1972). When science education was incorporated into the secondary school curriculum in 1963, there was a structural difference in the curriculum that was offered for boys and girls (Ssekamwa, 2000). The missionaries' aim of educating girls was to "produce a girl accomplished in all ways for the requirements of a housewife in Uganda" (Ssekemwa & Lugumba, 1973, p. 41). Consequently, the girls' curriculum consisted of "digging, plaiting mats, cooking and sweeping the floors" (Ssekamwa & Lugumba, 1973 p. 41). The objective of the missionary education was in line with Uganda's patriarchal heritage (Tamale, 2004, cited in Asimwe, 2008, p. 5). In patriarchal societies, the domestic roles of mother, wife and homemaker is the key construction of women's identity (Lynch & Feeley, 2009).

The cumulative effect of a gendered structured curriculum in schools has also resulted in some subjects and fields of work being defined as "feminine" and others as "masculine" in the minds of teachers, students and the larger society (Lynch & Feeley, 2009). Such gendered curricula in schools have also continued to reproduce gender based-stereotypes through specific subjects being exclusively allocated either to girls or boys to study (Kwesiga, 2002; Sutherland-Addy, 2002). Thus, through this practice, girls are discouraged from enrolling in purely scientific and technical subjects as directed by the predominantly male science teaching staff in schools (Bazikamwe, 1999;

Hoffmann-Barthes, Nair & Malpede, 1999). According to Kwesiga (2002), this practice limits girls' choice to enter various science courses in higher education institutions, and has partly promoted gender inequality in sciences even after the UN declaration on the elimination of gender disparities at all levels of education by 2015 (UNDP, 2000).

Gender inequality in students' participation in the sciences in educational institutions threatens the very nature and progress of development of our societies and nations (UNIDO, 2001). Educationists committed to the development of society view gender inequality in Science, Technology and Mathematics (STM) education as an opportunity and a challenge for different stakeholders to come up with affirmative ways of increasing girls' participation in the sciences (Tiffany & Burnette, 2004). The onus is, therefore, on all the relevant stakeholders in individual countries to develop and implement strategies and interventions aimed at closing the gap in STM education as perceived in the Millennium Development Goals summit (UNDP, 2000). The government of Uganda addresses this concern through the National Gender Policy Framework, which recognises gender as integral to all development initiatives. The science-based university sponsorship policy is one of the development initiatives launched by the Uganda government in 2005 (Akankwasa, official communication, March 7<sup>th</sup>, 2005).

The government of Uganda launched a Science-Based University Sponsorship Policy (GSBUSP) as an attempt to increase students' participation in science subjects in public universities in order to promote economic and social

transformation in the country (Businge, 2008; Kasozi, 2006; Ministry of Education & Sports [MoES] 2012). The Uganda GSBUSP stipulates reserving of 75% of sponsorship slots in public universities for courses considered critical to national development with emphasis on the sciences (Kasozi, 2006; Akankwasa, MoES official communication, March 7<sup>th</sup>, 2005). Only 25% of government sponsorship slots are allocated to art-based courses considered critical to national development compared to the 75% slots that are offered to Science courses (Ahimbisibwe, 2009b). This is the basis upon which this study refers to the Government's University Sponsorship Policy as "science-based".

Through the Uganda GSBUSP, the MoES envisages that the proportion of students taking science and technology would rise from 15% of Public universities' enrolment in 2004 to at least 30% by the year 2015 (Athmani, 2009). The benefits entailed in the Uganda GSBUSP for students include faculty allowance, fee waivers for meals, accommodation and tuition. It should, however, be noted this policy increased the number of government university sponsorship slots for students taking science subjects but with no provision of a positive discrimination for girls. The policy therefore expects the two genders to compete for equally the available government university sponsorship slots.

Some studies report the success of various science-based sponsorship policies in enhancing girls' participation in sciences. For instance; offering a fees waiver for the university science-based remedial courses intervention for the unsuccessful borderline female entrants in Kenya (Bunyi, 2009) and Tanzania (Mlama, 2001), sponsoring university education for girls who opt to study

science related disciplines while providing extra tuition fees to those who need additional support in their university science studies in Malawi (Gomile-Chidyaonga, 2003); and sponsoring the equipping of Secondary schools with science kits and the in-service training of teachers in their use in South Africa (Parliamentary Monitoring Group [PMG], 2004). However, other studies in USA (Kay, Steve, & Keith, 1994) and Ghana (Quaisie, 1996; Sutherland-Addy, 2002) reveal instances when sponsorship *per se* did not significantly promote girls' participation in science related careers.

In Uganda, no study has focused on the Uganda GSBUSP in relation to girls' participation in the sciences. Available studies have only focused on the enrolment of students in science subjects in secondary schools (Athmani, 2009; Kwesiga, 2002), female education in Mathematics and Science in Uganda (Mulemwa, 1997), the impact of the 1.5 Affirmative Action on girls access to University education (Musisi, 2001); factors affecting the choice of sciences by female secondary school students in Uganda at Ordinary-Level (O-level) (Asiimwe, 2008; Baguma & Muhairwe, 1999; Mulemwa, 1997; Opit, 1993) and the impact of a Mvule FAWEU private science-based sponsorship policy on O-level girls enrolment in sciences at A-level (Mvule Trust, 2007).

This study sought to establish the impact of the Uganda GSBUSP on girls' participation in sciences at A-level, comparative to the boys. The comparison would help to establish whether the policy is indirectly or directly favouring boys to study sciences, thus perpetuating the gender gap in sciences with more boys being enabled to take science courses. If this information gap is not filled,

the Ugandan government will continue to witness a widening gender disparity in the sciences in higher education, jeopardising the attainment of target #3 of the UN's MDG 3, of eliminating gender disparity at all levels of education by 2015. Lack of information on the impact of the Uganda GSBUSP on girls' participation in the sciences at A-level makes it difficult for policy makers to decide on the next set of actions to be implemented in order to eliminate gender disparity in science education in Uganda.

### **1.3 Statement of the Problem**

Science-based sponsorship policies with varying packages have been used to reduce gender disparities in the sciences in other countries such as Ghana, Kenya, Tanzania and Malawi. The Ugandan GSBUSP has different packaging as compared to that of Kenya or Tanzania and that makes it difficult for findings of their evaluations to be generalized to the Ugandan situation. In addition, while Kenya and Tanzania are benefiting from the fruits of their policy evaluations that have led to the development of other science based advocacy interventions for girls, the same is not yet true for Uganda's GSBUSP.

The Uganda GSBUSP provides science based sponsorship to students as a homogenous group without acknowledging that girls and boys have historical educational disparities. Boys have consistently been ahead of girls in their enrolment, performance and attitude towards the sciences (Muhairwe & Baguma, 1999; Mulemwa, 1997; Asimwe, 2008). Hence, in competing for this sponsorship girls' and boys' participation in the sciences may not increase at

the same rate as assumed in the policy's stipulation because boys have a pre-existing head-start over the girls. The study assumed that the policy is likely to perpetuate the gender gap in the sciences with more boys enabled to do sciences at A-level and in the universities. This issue, therefore, calls for an investigation to establish the extent to which the Uganda GSBUSP has influenced girls to participate in the sciences at A-level as compared to the boys.

#### **1.4 Purpose of the Study**

The purpose of the study was to establish whether the policy has led to an increase in the proportion of girls participating in the sciences at A-level to a parity level with the boys.

#### **1.5 Research Objectives**

The study was guided by the following objectives:

1. To compare the enrolment of girls and boys in the sciences at A-Level before and after the introduction of the government science-based university sponsorship policy.
2. To establish whether girls' awareness of the government science-based university sponsorship policy is related to their choice to enrol in the sciences at A-level as compared to that of the boys.
3. To compare the performance of girls and boys in the sciences at A-Level before and after the introduction of the government science-based university sponsorship policy.

4. To establish whether girls' awareness of the government science-based university sponsorship policy is related to their performance in sciences at A-level as compared to that of the boys.

### **1.6 Assumptions**

The study assumed that;

- i) The A-level students would be aware of the Uganda Government Science-Based University Sponsorship Policy (GSBUSP). This is because the Ministry of Education and Sports, parents, schools through career guidance departments and the mass media were supposed to have sensitised A-level students about the new science-based university sponsorship policy.
- ii) The number of girls enrolling and performing better in the sciences at A-level would significantly increase due to the inception of the Uganda GSBUSP.
- iii) In the context of Eccles' Subject-Task Value theory, girls would be inclined to choose to enrol and also perform better in the sciences at A-level for utility and cost value considerations; as a means of accessing the benefits contained within the Uganda GSBUSP at the university level.

### **1.7 Research Hypotheses**

The study was guided by the following research hypotheses:

- H<sub>1</sub> Girls enrolment in the sciences at A-level before and after the inception of the Uganda Government Science-Based University Sponsorship Policy is significantly lower than that of boys

- H<sub>2</sub> Girls' awareness of the Uganda Government Science-Based University Sponsorship Policy is not significantly related to their choice of the sciences at A-level as compared to that of the boys
- H<sub>3</sub> The number of girls who performed well in the sciences at A-level before and after the inception of the Uganda Government Science-Based University Sponsorship Policy is not significantly different from that of boys
- H<sub>4</sub> Girls' awareness of the Uganda Government Science-Based University Sponsorship Policy is not significantly related to their performance in the sciences at A-level as compared to that of the boys.

### **1.8 Limitations**

The context of the study was limited to only Wakiso and Mukono districts in central Uganda. These are only two out of 112 districts in Uganda (Nakayi, 2010). The results were, therefore, interpreted only within this study setting. This means that the findings from this study cannot be generalised to other districts in other regions of the country because they may not accurately reflect the situation in the districts in other regions of the country.

Though there are many ways in which girls participate in the sciences, this study did not examine all of them due to limited time. In this study, participation was confined to girls' choice to enrol in the sciences and performance in the sciences in Senior Six Uganda Advanced Certificate Examinations (UACE).

While the study was limited to the senior six students in six A- level schools, the researcher is aware that the policy may influence the participation of learners at different lower levels of the education system. These include students at Primary and Ordinary levels. Consequently, the results of this study cannot be generalised to the Primary school pupils and O-level students because their views were not captured by this study.

### **1.9 Delimitations**

The results of this study cannot be generalised to other districts, particularly with respect to Primary pupils and O-level students because of the existence of local conditions that make it impossible to talk of complete generalisation of results (Lincoln &Guba, 1985, cited in Hoepf, 1997). The concern of this study was, therefore, to generate information that can be used to provide an in-depth understanding of the problem in the context of Mukono and Wakiso districts. In this respect, the researcher agrees with Cronbach's (1975) observation in Asiimwe (2008) that 'when we give proper weight to local conditions, any generalisation is a working hypothesis' (p. 24).

### **1.10 Significance of the Study**

As an evaluation of the government's science-based university sponsorship policy, the findings of this study would in future serve as a basis for different stake holder store view and design effective government science-based sponsorship programmes that are inclusive of both girls and boys on equitable terms. For instance;

- The gaps identified in this study will serve as evidence-based foundation for policy review among government departments and other

education actors who have an interest in promoting girls' participation in sciences at A-level to a parity level with that of the boys.

- The Social Services Committee of Parliament, the Ministry of Gender and Social Services, and Development Partners interested in promoting students' access to education in the field of science would use this study findings as a reference of the importance of making policies that allocate resources, programmes and decision making to both girls and boys equitably because it is such strategies that help to eliminate gender disparity.

The report will also be given to public university libraries. The findings will serve as resourceful information that will be used in literature reviews of related studies and as teaching notes by researchers and lecturers.

### **1.11 Theoretical Framework**

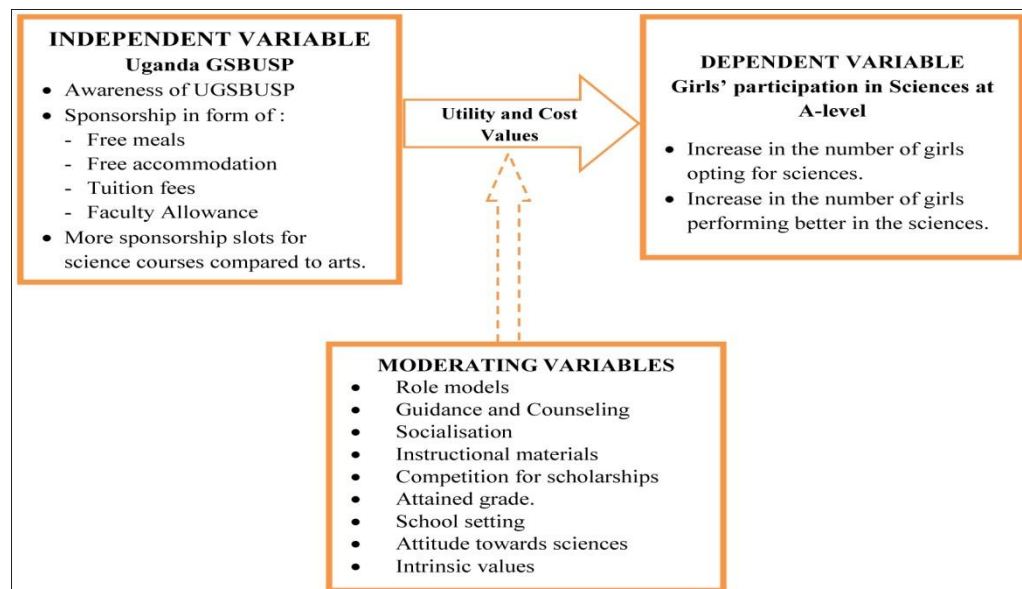
This study was guided by Eccles' (2005) Subject-Task Value Theory, which pre-supposes that a girl's choice and motivation to study a given subject is determined by the value she attaches to it. This implies that the value attached to a particular subject determines whether a girl will choose or reject to study a given subject. Eccles' (2005) Subject-Task Value Theory perceives value in four ways namely: attainment value, intrinsic value, utility value, and cost value (Eccles, 2005: p.1). Attainment value refers to the importance derived from having the ability to do well on a task as the basis for choice. Intrinsic value refers to the importance derived from the enjoyment one gets in carrying out a task of choice. The utility value is in reference to how important the task is for attaining some other short or long term goal. The cost value is associated

with the sacrifices one has to make to perform the task and the efforts required to complete it.

This study assumed that awareness of the benefits entailed within the Uganda GSBUSP would motivate girls at A-level, including those who have minimal interest in the sciences, to study the sciences for the utility value consideration as conceptualised in Eccles' (2005) Subject-Task Value Theory. The benefits offered within the Uganda GSBUSP package include: faculty allowance, fee waivers in form of tuition, meals and accommodation, and more sponsorship slots for science courses as compared to those for the arts.

### 1.12 Conceptual Framework

Under the auspices of Eccles' (2005) Subject-Task Value Theory, the conceptual framework in Figure 1.1 was developed to guide the current study.



*Adapted from Eccles (2005) Subject Task Value Theory*

**Figure 1.1 The UGSBUSP and girls' participation in the sciences**

Figure 1.1 presents the independent variable as the Uganda Government science-Based Sponsorship Policy (UGSBUSP). Awareness of the Uganda GSBUSP was expected to motivate girls to participate in the sciences at A-level as a means of becoming beneficiaries of the incentives contained within the policy's university sponsorship package. In this context, girls were expected to choose to study the sciences at A-level for the utility value consideration of becoming beneficiaries of government sponsorship at the university level. Furthermore, girls would choose to do the sciences at A-level even at a cost. This cost involves some girls choosing to study the sciences that they are not good at instead of the Arts that they are better in and working hard to pass them well, so as to qualify for government science-based university sponsorship. In addition, parents and school communities that desire to have many of their students admitted to the university on the government science-based sponsorship would have to make sacrifices so as to motivate girls to study and pass the sciences at A- Level.

Figure 1.1 also shows that girls' participation in the sciences at A-level could also be enhanced or inhibited by moderating variables. The moderating variables that could enhance girls' participation in the sciences besides the benefits entailed within the Uganda GSBUSP were perceived as secondary reasons in this study. The influence of these variables is secondary to that of the policy because they were not the primary concern of this study, though they could influence the increase in the number of girls' participating in the sciences. Such variables include; influence of role models outside the family

circles(Seymour & Hewitt, 1997) and within the family circles(Backer& Leary, 1995), girls' ability to do the sciences well (Gilbert & Calvert, 2003; Evans 2002), home based science experiences (Baker &Leary, 1995), and love for the sciences (Gilbert and Calvert, 2003).

Some moderating variables could also hinder girls' participation in the sciences, despite their awareness of the sponsorship policy. Such variables include girls' perception of science subjects as hard and masculine (DeBacker & Nelson, 2000) and discouragement from parents, peers and teachers due to gender beliefs (Eccles & Wingfield, 2002; Turner, Steward, & Lapan, 2004). According to Graham (2001), traditional science classes are highly competitive and test scores are often low and this makes students, especially female students, not consider science as a possible career. According to Eccles (2005), women are less likely to choose jobs that cannot easily accommodate their domestic and other related roles. A number of women see scientific work as unfeminine because it is highly 'individualistic', 'competitive', 'solitary', and requiring a high degree of personal autonomy (Gilbert & Calvert, 2003, p. 871).However, the benefits of the Uganda GSBUSP were expected to be so attractive to the girls that they would opt to study the sciences in spite of these obstacles. In this context girls were expected to make sacrificial effort so as to overcome the factors that would constrain them from studying the sciences at A-level. The girls' sacrificial effort in this case is conceptualised in Eccles' (2005) Subject Task Value theory as the cost value consideration.

In summary, the utility value consideration as conceptualised in Eccles' (2005) Subject-Task Value theory is expected to be the primary reason for girls' choice to participate in the sciences at A-level. In this study, the moderating variables that could either motivate or de-motivate girls' participation in the sciences. Even amidst the inhibiting factors, girls were expected to sacrificially consider participating in the sciences at A-level for the sake of becoming beneficiaries of the government science- based university sponsorship.

### **1.13 Operational Definition of Terms**

**A-level arts subjects:** In Uganda, Arts subjects include Geography, Economics, Literature, Divinity, History, Languages (French, Luganda and German).

**A-level science subjects:** In this study, these include chemistry, physics, mathematics, technical drawing, agriculture, food science, home economics, fine art, and sub-maths.

**Co-education:** This refers to a system of educating girls and boys together within a school set up.

**A Principle Pass:** In Uganda, this refers to the grade given to scores attained by an A-level student in national examinations. These grades range from A as the highest Principal pass of six points to E as the lowest Principal pass of two points (UNEB, 2012).

**Performance in the sciences:** Refers to the level of a student's work effort in learning, understanding and applying the subject matter in science subjects' examinations. Good performance by a student in science exams entails

attaining two to four Principal passes (2-4 PPs) at A-level, which makes him/her qualify for recruitment into a degree course at the university. Poor performance, on the other hand, entails attainment of one to zero (1-0 PPs) Principal passes, which makes one not to qualify for recruitment into a degree course at the university (PUJAB, 2011).

**Sponsorship:** It is the financial support from a sponsor to an individual or category of students to facilitate their education and career-related pursuits. In this study, the sponsor is the Government of Uganda, which is giving preferential slots of its financial backing to students studying the sciences at university level as a means of promoting the country's economic and social development through science education.

**Gender:** Refers to the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for men and women, while sex refers to the biological and physiological characteristics that define men and women. In this study, gender was used as a variable that is assumed to influence the participation of boys and girls in science subject options.

**Gender Equity:** It refers to making provision for the more marginalized gender groups with respect to rights to social goods and amenities such as education.

**Science-Based Sponsorship:** It refers to the provision of funding strategically inclined to promote students' participation in science related education activities.

**Awareness of the Uganda GSBUSP:** This refers to having the knowledge that the Uganda government mainly sponsors science courses at the university level

which entails faculty allowance and fee waivers in terms of tuition, meals and accommodation.

**Impact:** Denotes the influence of the policy on girls' participation in the sciences. In this study it refers to the extent to which girls' awareness of the policy relates with their choice to enrol and perform better in the sciences at A-level.

**Participation:** Refers to girls' enrolment and performance in the science subjects' examinations.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

In this chapter, the researcher reviews literature related to the topic of study, which focuses on the promotion of science education among girls. Within this literature, the researcher explains the benefits of having female scientists, differences between girls' and boys' participation in science, and the relationship between science-based sponsorship policies and girls' participation in the sciences.

#### **2.2 The Benefits of Having Female Scientists**

The participation and the pivotal role of women in science and technology cannot be over-emphasized in national development (Hermawati & Luthulima, 2000; Kalesanwo & Bilesanmi-Awoderu, 2009). African women who have accessed science-based higher education have proved their capabilities in the field through their performance in active scientific outputs and leadership positions as noted in the work of a South African Professor Anusuya Chinsamya-Turan, an outstanding scientist who has earned international acclaim as a Palaeobiologist. According to Shoprite Holdings Ltd. (2005), her innovative research on the microstructure of fossil bone has led to a significant advancement in the field of Palaeobiology and to a better understanding of the biology of a variety of extinct fossils. According to the University of Pretoria (2010), South Africa's Professor Brenda Wingfield, too, has been recognized for her pioneering work in Molecular Biology, which has brought significant economic gains for the forestry industry and the country as a whole. She is also

a winner of several African Union Women in Science Regional's (Southern) Awards.

In the UNHABITAT (2006), the East African former Executive Director of the UN—the Tanzanian-born Dr. Anna Kajumulo Tibaijuka- is to date the highest ranking African woman in the United Nations staff inventory. She is the author of various books and research papers on agriculture and rural development, farming systems, food policy, agricultural marketing and trade, sustainable development, social services delivery, gender and land issues, and environmental economics. The Greenbelt Movement (2012) documents the late Kenyan Professor Wangari Muta Maathai, as the first African woman in East and Central Africa to earn a doctorate degree and to enter the ranks of Nobel Peace Prize winner in 2004. According to the Greenbelt Movement, Professor Maathai was internationally acknowledged for her struggle for environmental conservation and served on the board of many organisations.

Similarly, Talemwa (2010) hails Uganda's professor Mary Okwakol as one of the few women scientists in Uganda who have contributed immensely to the advancement of the sciences. According to Talemwa, Professor Okwakol stands out as an icon of science and received an international award of the year 1997/1998 from Makerere University for her role in environment conservation. Her other accomplishments include serving as Deputy Vice Chancellor of Gulu University, where she spearheaded the development of a unique Bachelor of Agriculture Programme, participating in the development of the Bachelor of Medicine and Bachelor of Surgery programmes, and was the first woman

member of Trustees of the Uganda National Parks (UNP) in 40 years, during which time she led the merger of UNP and Game department into the present Uganda Wildlife Authority (UWA). Additionally, she was among the initiators and developers a GEF/UNEP project on the Conservation of below Ground Biodiversity for sustainable land production in seven tropical countries including Brazil, Cote d'Ivoire, Kenya, India, Indonesia, Mexico and Uganda. She is also the founding and current Vice Chancellor of the agricultural based Busitema University in Uganda.

Through their inventive and creative spirit, female scientists bring different ideas and perspectives required in the development of science and society. According to Doss (2001), girls' perspectives have become useful ways of reflecting on societal requirements in product development in industries such as in China (Ainuddin et al., 2005), Indonesia (Hermawati & Luthulima, 2000) and in developing countries (FAO, 2000; FAO, 2002). Scholarly evidence also reveals that in the USA, companies with higher percentages of female officers produced better products and performed at higher rates than companies with lower female percentages (OECD, 2009).

Participation of women in Science Engineering and Technology (SET) development projects has contributed to enhancing women's self-confidence and communication skills (Hermawati & Luthulima, 2000). Women's entry in the Information and Communication Technology (ICT) industry has had some socio-economic impact. Studies of village pay phones in rural Bangladesh (Richardson, Ramirez & Haq, 2000) and computer-aided technologies and

teleworking in Malaysia and India(Gothoskar, 2000; Kelkar, 2002;Mitter & Sen, 2002; Ng, 2001) have shown that household income has increased, and women have more mobility and more say in domestic matters (Eurostat, 2004).

Women's participation in healthcare technology offers them the possibility to gain control over unwanted pregnancies, to protect themselves against sexually transmitted diseases (Ainuddin, et al, 2005), and to experience the separation of sexual activity from reproduction(Schenk, 2002).

The literature in this section reveals that facilitating and promoting women's access to Science, Technology and Mathematics (STM) not only spurs national economic growth, but enables them to create, receive, share and use information and knowledge for their cultural, economic and political development. Yet, despite the validity of this universally convincing assertion, women's participation in science related fields is curiously low as shown in section 2.3 of the Literature review.

### **2.3 Girls' and Boys' Participation in Science**

Participation in this context refers to girls' and boys' enrolment in science related disciplines and performance in science assessments.

#### ***2.3.1 Girls' and boys' enrolment in the Sciences***

Many studies conducted in various parts of the world have shown that on the whole, more boys than girls are favourably disposed to science and mathematics. This is evidenced by the larger representation of boys as compared to girls in the science-based programmes, especially in the physical sciences at post primary level as established in Uganda (Kwesiga, 2002),

Nigeria (Balogun, 1994) and the USA (Valianthan, 2004). This scenario holds true in the developed and developing countries, and, according to research findings, the situation is worse in the latter.

Increasing the recruitment of women in scientific and technological studies is the objective for all European Union (EU) countries (Commission of the European Communities (CEC, 2008). Despite their progress, OECD (2009) and CEC (2008) found that the gender imbalance in favour of males amongst STM students and graduates is still pronounced, especially in the disciplines of engineering and computing. An earlier study by OECD (2006) also found that apart from the life sciences, the proportion of women choosing science and technology studies were below 40% in most OECD countries.

In the USA, women have consistently been proportionally under-represented in science and technology. In these disciplines, as students move from high school to colleges and to graduate programmes, women drop out at higher rates than men (Kwesiga, 2002). For example, at the high-school level, girls make up only one-third of the advanced physics students, and only 15% of those enrolled in advanced computer science classes (OECD, 2007). At the post-secondary level, female bachelor's degree students are much less likely than their male peers to major in computer science, engineering, and physical sciences. The above observations point to the fact that even in the United States, which internationally has the highest representation of women doing/studying the sciences (Beede, et.al, 2009), more boys than girls are still enrolled in the sciences.

Similar gender disparities in enrolment in science education exist in Britain. According to the British Parliament (2009), A-level entries for science and mathematics in schools and colleges between 1996 and 2005 revealed that the proportion of girls doing chemistry, mathematics and physics was comparatively low. The most problematic subject was physics, having a big proportion of female students dropping out of it since 1998. In Japan, only 11% of the eligible female students opt for science-based education in secondary schools because they are often discouraged by their parents (Muir, 2007). The situation in Japan shows that girls' under-representation in the sciences is majorly influenced by parents, who believe that science is not for girls.

The trend of girls' under-representation in the sciences is also found in the developing world, particularly in the African countries. Quaisie (1996) reported that in 1992, only 23% of students who registered for science at the senior secondary school level in Ghana were girls. Likewise, in Zambia, Hoffman-Barthes and Malpede (1999) reported that although girls' participation in the sciences had been increasing in secondary schools since 1998, females still formed approximately 15-16% of students in Physics and Chemistry. These authors further reported that in the tertiary institutions in Zimbabwe, only 2% or fewer females enrolled in disciplines such as science or engineering. In Kenya, women's participation rate in engineering courses was 1.6% and 24% for medical and health related courses (Gender, Technology & Science (GTS) Gateway, 2004). According to FAWE (1995, cited in Kwesiga, 2002, p.71), in 1990, the total tertiary enrollment of females in scientific

courses was estimated to be 11% in Benin and Burkina Faso, 34% in Angola, 14% in Ghana and Cameroon, 12% in Mali and 27% in Swaziland.

In Uganda, the total tertiary enrollment of females in scientific courses was estimated to be 13% in 1990 (FAWE, 1995 cited in Kwesiga, 2002). Commenting on this percentage, Nziraguhunga (1989) observed that in Uganda, the number of girls studying sciences in tertiary institutions was so small that ‘one was left wondering whether girls were capable of studying sciences...’ (p.46). Similarly, Makerere University’s admission list of the 2008/2009 academic year for the Government University students showed that boys dominate the science-based programmes while girls dominate the arts courses (Ahimbisibwe, 2009b). For example, only one girl was admitted to study Pharmacy, out of 18 students. Out of the 24 students admitted for Environmental Management, only four were girls. Out of the 15 students admitted for guidance and counselling, only five were boys. Twenty four of those admitted to study medicine were girls, while 52 were boys. With regards to Law enrolments, there were 67 girls and 9 boys.

The findings in this section show that few girls are enrolled to study STM related courses in the first and third world countries. The question therefore is: do girls who enrol for the sciences at different levels of education perform as well as the boys? Are they able to perform as well as boys in the science domain that has traditionally been for boys? These questions are subject for discussion in the next sub-section.

### ***2.3.2 Girls' and boys' performance in the Sciences***

Findings from the Programme for International Students Assessment (PISA) (2000-2006, cited in CEC, 2008) and OECD (2009) revealed no difference in average science performance between boys and girls in the EU countries. Similarly, surveys done in the European Union (EU) countries by Hannan, Smyth, McCullough, O'Leary & McMahon (2006) reveal that girls in the elementary and secondary schools had similar rates of academic attainment in the sciences with the boys. These findings are supported by Spelke's (2005) psychological research which found no differences in boys' and girls' overall aptitude in mathematics and science. According to CEC (2008) and OECD (2009) there are instances in 12 EU countries where girls out-performed boys in PISA tests. Similarly, Quaisie (1996) and Sutherland-Addy (2002) in Africa found that secondary school girls in Ghana perform just as well as boys, and, in some cases, even better.

Though the aforementioned findings portray girls as performing equally well as boys in the sciences, other studies show contrary findings. Bunyi (2009) and Mlamba (2001) in Kenya, Masanja (2001) in Tanzania, Chivaura (2000) in Zimbabwe, and Cham'dimba (1997) in Malawi reported that few female secondary school students attain high marks to compete on an equal footing with their male counterparts for the limited STM places in colleges and universities. The very poor performance of female candidates in mathematics and science was the basis for the introduction of the Affirmative Action policy of 'awarding bonus points' to girls. According to Bunyi (2009) and Masanja

(2001), even ‘awarding bonus points’ to girls could not get them into the very competitive SMT related program in tertiary institutions.

Findings cited in this section reveal that in some countries, girls perform just as well as boys in science assessment tests. In some cases, girls even outperform boys in the science assessment tasks. However, there are also studies that reveal that in some countries, girls significantly under-perform in science assessment tasks as compared to their male counterparts.

It should, however, be noted that women’s under-enrolment and under-performance in science education limits their participation in the science domain. Women’s under participation in the science domain is vital in the development of society as depicted in section 2.1. It is, therefore, necessary to establish causes of women’s under-participation in the sciences in the formal education system.

### ***2.3.3 Causes of girls’ under-participation in science in formal education***

Many studies conducted in different parts of the world as depicted by the literature in sub-sections 2.3.1 and 2.3.2 have revealed that more boys than girls participate in science education. Available scholarly evidence reveals that the reasons for girls’ low participation in science education are both school and non-school-related in nature (Asiimwe, 2008, Bunyi, 2009; Kwesiga, 2002; Lynch & Feeley, 2009).

### ***2.3.3.1 School-based reasons for girls' low participation in science***

A number of studies show how teachers' gender-stereotyped behaviour and expectations undermine girls' confidence in their mathematical and science abilities, and eventually discourage them from choosing courses related to these disciplines in secondary schools (Eccles & Wingfield, 2002; Turner, Steward, & Lapan, 2004). For example, Mewborn (1999) in the USA and Asiimwe (2008) in Uganda found that teachers contribute to boys' dominance in whole-class discussions. Teachers contributed to this disparity because they did not give girls a chance to talk, disregarded what they said when they got the chance, and did not take them seriously as equal participants in the classroom. Adams (1996) observed that it is the compliance with the outmoded masculinisation of the sciences that makes some teachers in the USA to discriminately encourage boys to be assertive, curious, questioning and active. Girls who exhibit such behaviour are labeled as obnoxious and bossy by teachers in Ghana (Quaisie, 1996) and USA (Adams, 1996). The above mentioned findings are a manifestation of the ways in which teachers masculinise the sciences and discourage girls from pursuing science related careers (American Association of University Women, 2002).

According to Kakinda (2007), secondary school head-teachers in Uganda attributed girls' low participation in the sciences to inadequate science equipment, materials and laboratories. In an earlier study in four African countries including Uganda, Cameroon, Tanzania, and Ghana, O'Connor, (2002) also reported that majority of the schools, both primary and secondary,

lacked teachers, textbooks, laboratories, chemicals, tools and equipment, teaching aids, stores, and offices. The teaching approach in these schools tended to be teacher-centred. In this type of teaching approach, the teacher is the sole source of knowledge for the learners. This can be risky in the event that the teacher is inadequately informed on the subject, or is not adequately trained in the art of communication. A teaching approach that centres on the teacher is bad for science teaching and learning, and soon kills the interest of students, girls inclusive, in the subject.

Studies done in Germany, France (Sagebiel & Dahmen; 2006) and the USA (Graham, 2001) reveal that some women do not opt for engineering and science courses due to peer discrimination. According to Whittock (2002), it is the masculinization of the sciences by the general society that makes girls to be discriminated and unwelcome in science classes by their male counterparts. In Austria, Greece, and Slovakia, the few young women in the science classes reported they felt isolated and lonely in these classes because the men were not comfortable with their presence. The men perceived “STM to be their game and there was no place in their prestige system for a woman who competes successfully with them” (Etzkowitz, Kemelgor, & Uzzi, 2000 p. 55). In Ghana, girls who study technical subjects in the sciences are considered “un-ladylike, Mrs. Hammer” while boys who study the so called ‘feminine subjects’ are laughed at by their friends and considered “weak, lazy, Mr. Apron and poor achievers” (Quaisie, 1996, p. 3). The girls’ perception of the sciences as a male domain also discourages them from pursuing science careers. Some female

students in France, Germany and Austria felt that being in the science domain makes one unfeminine and, therefore, sexually unattractive in a heterosexual world (Sagebiel & Dahmen, 2006). This finding is supported by Connell's (2005) and Kessels' (2005) observations that adolescents are expected by peers to choose subjects that affirm their identities as desirable females or males, generally, but not always, in the heterosexual sense.

The scarcity of female role models in STM disciplines is another way in which the science domain is masculinised in Educational institutions. Rathgeber (2002) in Africa countries and Sengers, Levelt, Shanahan and Castillo (2008) in the EU countries found that the absence of female science teachers as role models in schools discouraged girls from participating in the sciences. According to Bussey and Bandura, (1999) this is because children learn subject stereotypes by observing the subjects mostly taught by males and females, and subjects most popular among boys and girls. Bussey and Bandura's (1999) theory is attested to by the Texas Education Excellent Project in the USA, which revealed that test scores for American girls were higher in districts that had higher percentages of female teachers (Government of USA, 2001). Aramanzan and Mutuwa (2005) also found that the rise of the number of female students in the ICT undergraduate programmes in Makerere University in Uganda corresponds to the faculty's Affirmative Action of employing 50% female instructors. Scholarly evidence further shows that having small numbers of women in the STM disciplines made some girls in Austria, Germany, France

(Lynch & Feeley, 2009) and in the USA (DeBacker & Nelson, 2000) to perceive science education as a male domain.

In schools, Science and Mathematics textbooks, classroom languages, examples, charts and models portray the male image of science. This practice is a form of marginalisation of girls in the sciences, which makes boys to tune into science subjects and girls into the domestic sciences (Kadzamira,1997). Sutherland-Addy (2002) in Ghana, Kalyati (1996) in Malawi, and Wood (2000) in the USA found that the exclusive appearance in text books of men who are doing scientific things discourages girls from studying the sciences.

Research in assessment methods reveals that the exclusive use of standardized test scores for recruiting students into STM courses inhibits the furtherance of girls in the sciences. Evans (2002) found that in the USA, girls on average receive better grades in school tests than in the standardized tests. AAUW (2002) also found that girls who obtain the same Scholastic Aptitude Test (SAT) scores with the boys outperform them in college tests. Consequently, Evans observed that education institutions that exclusively use scores of standardized entrance exams for recruiting students for further studies in the various science programmes inhibit girls from furthering their education in the sciences.

#### ***2.3.3.2 Non-school based reasons for girls' low participation in the sciences***

According to ILO (2004) and NSF (2004) the gender pay gap commonly experienced in European countries greatly contributes to girls' low participation in the sciences. The gender pay gap refers to the unequal pay for

equal work (European Commission, 2000). In most European countries, women in scientific and technological professions receive lower salaries than men (European Commission, 2000). Envisaging a working environment where one will not be gaining labour market advantages that are in line with their academic achievement has discouraged some girls in EU countries from choosing a science-based career (Connell, 2002).

The scarcity of female role models in the work places also discourages girls from studying the sciences (Sagebiel & Dahmen, 2006). This is worsened by the inadequate political will to institute Gender Empowerment Measure (GEM) policies in the STEM fields both in education and work place institutions by governments in developing countries (European Commission, 2000). In Uganda for instance, there is no policy on girls and science in particular (Baguma & Muhairwe, 1999). Such a policy would address issues such as the university intake of girls taking the sciences and coaching in science, especially for girls.

According to Bedard and Cho (2007), students carry into the school parents' and society's gendered assumptions that science subjects belong to the masculine domain. For instance, Muira (2006) in Japan and Tiffany & Burnette (2004) in the USA found that girls' negative attitude towards science disciplines at school was due to the influence of parents who tend to encourage males more than females to pursue advanced and elective science courses. Yryonides (2007) in Cyprus, too, found that parents invested more in their sons' education in the sciences despite the fact that they professed to believe

that both girls and boys should be treated equally. Mothers and fathers in Canada were also found to give preferential treatment to their male children in the development of scientific language, thinking and activities (Crowley, Callanan, Tenenbaum & Allen, 2001). Similarly, in a study of three communities in the USA, Weiss (2001) found that while sexism was often not overt among parents and adults working with youth, there were frequently subtle but pervasive messages of "under-expectation" of girls in terms of mathematics and science and overprotection and "rescue" of girls from making mistakes and assessing risks.

Girls have low self-esteem towards the sciences. According to OECD (2007), despite the girls' equal abilities and good performance in the sciences, in 22 out of 30 OECD countries, males were significantly more assured about their abilities in science than females, who generally reported a lower self-concept regarding the sciences. Girls' lower academic self-image in the sciences inhibits some of them from entering scientific fields. Adams (1996) found that this low self-perception leads to a pattern of self-helplessness among girls with respect to science and mathematics, with success in these disciplines being attributed to luck, and failure to lack of ability. In the case of boys, the opposite is true (Smith, 1992). For instance, in Nigeria, girls opt out of the sciences because they are considered unable to think or work scientifically (Agholor, 1993; Okafor, 2002). The above studies reveal that the misconception of the sciences as a male domain by society in general, and girls in particular, lowers girls' self-esteem towards the sciences, while it boosts that of the boys. It is on

this basis that men often feel obligated to stay in the sciences even when they encounter a discouraging academic atmosphere, while girls feel they have the permission to leave (Seymour & Hewitt, 1997). Some studies in Africa, however, reveal that girls in Malawi (Cham'dimba, 1997), Kenya (Bunyi, 2009), Tanzania (Masanja, 2001) and Zimbabwe (Chivaura, 2000) are underrepresented in the science related disciplines in the tertiary institutions due to their low achievement in the National Junior and High school examinations.

Community distractions in the form of girls being distracted by men and doing a lot of community work like cleaning churches, cooking at weddings and escorting brides have also been documented as being responsible for girls' poor performance in science subjects in Uganda (Baguma & Muhairwe, 1999) and Ghana (Quaisie, 1996).

Earlier and recent studies done in Uganda reveal that strict parental control including strict rules often given to girls at home prohibit them from interacting with the opposite sex (Asiimwe, 2008; Baguma & Muhairwe, 1999; Mulemwa, 1997). Such strict parental control denies girls the chance to freely consult and discuss with their male counterparts and teachers, thus missing the help they may have received aimed at improving their performance.

DeBacker and Nelson (2000) and Jones, Howe and Rua (2000) in the USA, and Mulemwa (1997) in Uganda, found that girls have fewer out-of-school science experiences than boys. This imbalanced exposure to scientific out-of-school experiences gives boys an environmentally-induced advantage in math and science even before they are introduced to these subjects in school (Aldridge &

Goldman, 2002). This situation is worsened by girls' fear to ask for help from male teachers, and male teachers' lack of assistance to girls to promote their performance for fear that people may suspect and accuse them of love relationships (Mulemwa, 1997).

Science courses require lengthy training. According to (Baguma & Muhairwe, 1999; Mulemwa, 1997) in Uganda and Agholor (1993) in Ghana, girls and society have the mythical fear that by the time one graduates from these courses, they would be too old to fare well in marriage. In the Ugandan context, girls keep out of the sciences because of such a naive idea and misconception about science courses.

Despite all the above obstacles to girls' participation in the sciences, there is an urgent need to encourage women's participation in science education. Failure to train and utilise women's potential in the science is detrimental to the economies of societies at macro and micro levels (Jochimsen, 2007). The benefits of women's participation in the science as shown in section 2.1 confirm Jochimsen's assertion. Available literature reveals that different concerned nations in collaboration with NGOs have instituted various approaches to this effect. Science-based education sponsorships are among the various strategies that have been used in many parts of the world to encourage and increase girls' participation in science education. Thus, the next section of the literature review presents information on the science-based sponsorship policies that have been used in various countries as strategies to promote girls' participation in science education.

## **2.4 Science-based sponsorship policies and girls' participation in the sciences**

In this study, science-based sponsorship policies refer to the guidelines developed by governments and Non-Governmental Organisations (NGOs) for administering their sponsorship, which is skewed or exclusively geared towards funding science-based activities. Science-based sponsorship policies are put in place with the prospect of achieving improved participation of a targeted group of students in the field of science. The next sub-section presents literature on the influence of science based sponsorship policies on girls' enrolment in science.

### ***2.4.1 Science-based sponsorship policies and girls' enrolment into sciences***

Available literature reveals conflicting findings on the influence of science-based sponsorships on girls' enrolment in science. Some studies reveal instances when science-based sponsorship has attracted girls into science careers. For example, Bee, Puck and Heimdahl (2007) found that science-based advocacy sponsorship motivated girls in the USA to enrol in the sciences. Specifically, they found that junior high school girls attending Science, Technology, Engineering, Preview Summit (STEPS) advocacy camps are 9.6 times more likely to pursue an engineering or technology degree and 4.8 times more likely to pursue a natural science degree than their contemporaries. MacDonald's (2002) study in Canada also revealed that a high number (73%) of past Operation Minerva science camp participants were pursuing at least one science course at the post-secondary level and 82% of them would consider a future science career. These findings indicate that exposure to a female

scientist role model and a scientific workshop encourages junior high female students to consider a future career in science.

It should be noted that although Canadian and USA governments sponsor the education of senior high school students, the majority of the girls avoid studying the sciences at this level (MacDonald, 2002). This scenario underscores the fact that the government tuition fee waiver *per se* does not attract junior high school girls with minimal interest to opt for STM subjects at post compulsory levels. This is the basis upon which the junior high school girls are sponsored to participate in the science-based advocacy holiday camps. The science-based sponsored camps are an affirmative intervention for raising girls' awareness and interest in the sciences, so they could choose to enrol in STM courses at post compulsory levels (MacDonald, 2000; Bee et al, 2007).

In Ghana, sponsorship of a science-based advocacy project significantly increased girls' enrolment in science and technology-related subjects in secondary schools (Quaisie 1996). At the onset of the sponsorship of the advocacy project in 1987, only 11% of the girls sat for the GCE "A" level science examinations. Five years later, in 1992, the number of girls who registered for the GCE "A" level science examinations increased by 13% (Quaisie, 1996). However, the sponsorship of Science, Technology and Mathematics Education (STME) Clinic for Girls in Ghana did not significantly reduce the gender gap between the boys' and girls' enrolments in the sciences at A-level(Quaisie, 1996). In addition to the STME clinics, universities in Ghana practice positive discrimination in favour of female students. According

to Sutherland-Addy (2002), the universities reserve 20% of places in the School of Medical Sciences for female students. Consequently, the rate of women's participation in medical sciences has moved upwards. In the University of Ghana, women's participation increased from 5.8% to 10.3% in the 2000/01 academic year. At Kwame Nkrumah University of Science and Technology, women participation increased from 11.4% to 14.6% during the same period. This finding shows that the Affirmative Action of reserving specific slots for girls is a practice that enabled universities in Ghana to promote girls' access to government science sponsored courses in public universities. It is a pro-active measure that addresses the MDG #3 requirement for gender equity in enrolments.

In Malawi, the Human Resource Integrated Development (HRID) project's university science-based sponsorship increased girls' enrolment in some STM related courses. According to Gomile-Chidyonga (2003), the Environmental Health programme grew from 9% to 27% female intake while those of the Information Technology, Business Information and Laboratory Technology Diplomas were at 50% female intake. The Bachelor of Technical Education grew from 8% to 39%, the Bachelor of Accountancy program, which is mathematics competence-based increased from 14% to 25% between 1999 to 2002 whereas the Civil Engineering (B.Sc) and the Electrical Engineering registered a minimal growth in the representation of females from 13% to 15%, and 7% to 9%, respectively, between 1999 and 2002.

According to Masanja (2001), sponsorship offered to borderline female candidates in Tanzania to study remedial courses in science and mathematics increased girls' enrolment in the STM programmes in the University of Dar es Saalam. Between 1997 and 2000, 214 female students entered highly competitive SMT related programmes such as engineering, medicine, and architecture through this route (Masanja, 2001). Masanja further reports that through the science-based remedial course sponsorship, some faculties such as Physical Education, Sports and Culture and Nursing easily attained gender parity in admission. Masanja also observed that remedial courses as a form of Affirmative Action (AA) helps girls fill in whatever knowledge gaps they may have had on the relevant respective subjects.

It is worth noting that the success of the science-based remedial courses' sponsorship in increasing girls' enrolment in the STM university courses in Tanzania was due to the multifaceted approach of its implementation. Girls who enrolled in the university's STM programmes as a result of benefiting from the remedial courses' sponsorship were also beneficiaries of two other inter-reliant AA initiatives namely; lowering of university admission cut off points for females and the institution of remedial bridging university entry courses for borderline students who do not meet the departmental entrance score requirements. Therefore, the AA initiative of sponsoring females to undertake remedial bridging courses *per se* would not have led to a significant increase in girls' enrolment in STM courses. This implies that science-based sponsorship is more effective in increasing girls' enrolment in the sciences

when it is implemented with other relevant science-based interventions in a multifaceted approach.

In Makerere University in Uganda, Aramanzan and Mutuwa (2005) found that donor science-based sponsorships focusing on women increased female enrolment in the sciences, particularly in the faculties of Agriculture and ICT. For instance, the Female Scholarship Initiative (FSI) offers scholarships to females admitted to Makerere University, 70% of whom must be science students. In addition, the faculties of Agriculture and ICT also offer scholarships to brilliant female students. However, the funding for these scholarships may not be available perpetually since it is largely sourced from donors. Therefore, the government needs to plan and provide for a sustainable source for such sponsorships.

Some studies, however, show that science-based sponsorship policies do not always attract students to study the sciences. For instance, Kay, Steve and Keith (1994) in the USA found no relationship between the science-based Oklahoma Future Teacher Scholarship (OFTS) and the retention of potential teachers in science education at university level. Eighty two per cent (82%) of the recipients indicated that they were not enticed into the field of science by the scholarship (Kay et al., 1994). The findings revealed that the reason why the OFTS recipients went into the teaching of the sciences was because the teachers liked teaching science subjects. Though the Kay's study did not report the impact of the sponsorship by gender, it shows that sponsorship per se may not attract students to study the sciences.

The experience in Malawi reveals that even after the introduction of a private science-based university sponsorship policy in 1987, female representation did not improve in two out of seven STM programmes in its Polytechnic University. According to Gomile-Chidyaonga (2003), girls' enrolment for the degree of Architecture (mature entry) decreased from 33% in 2000 to 31% in 2003 while Mechanical Engineering had no female representation from 1999 to 2003. This was because the very poor performance of female candidates in subjects such as mathematics and science could not get them into these very competitive mathematical and technological related programs in the tertiary institution. This scenario suggests that sponsorship *per-se* cannot attract girls to enrol for sciences in tertiary institutions. In this context, the science-based sponsorship initiative should have been accompanied by some other supportive measures that enable girls to score high grades in the sciences so as to enable them to qualify for the highly competitive STM courses in tertiary institutions.

In Uganda, available studies on science-based sponsorship focused on the sponsorship by Forum for African Women's Education-Uganda (FAWEU), which was implemented by The Mvule Trust organisation. The Mvule Trust Annual Report (2007) revealed no significant increase in the number of girls studying the sciences at A-level through the sponsorship. The girls' low O-level grades in science did not enable them to qualify to study sciences at A-level (Mvule Trust Annual Report, 2007). The findings of the Mvule Trust Annual Report underscore the fact that the availability of A-level sponsorship without good O-level grades does not guarantee girls' increased participation in

the sciences at A-level. Such girls need a multifaceted sponsorship approach that includes measures that empower them to obtain good grades in the sciences both at the primary and secondary school levels.

Uganda GSBUSP takes A-level students while those in the FAWEU-Mvule science-based sponsorship project were O-level girls. The criterion for selecting the A-level students for the Uganda science-based government university sponsorship is exclusively on merit (Akankwasa, official communication, March 7<sup>th</sup>, 2005). The Mvule-FAWEU A-level science-based sponsorship was mainly for girls from the low socio-economic status background. Therefore, unlike the Mvule-FAWEU study, the current study sought to establish the influence of an academic merit science-based sponsorship on girls' participation in the sciences at A-level.

#### ***2.4.2 Science-Based Sponsorship and Girls' Performance in the Sciences***

In South Africa, sponsoring the equipping of secondary schools with science kits, and training science teachers to use them well increased the number of female African and coloured learners passing mathematics and science by 15% and 71% nationally (PMG, 2004). According to PMG, this sponsorship was offered through the Dinaledi project to 102 selected secondary schools nationwide to improve performance of the historically disadvantaged learners in MTS. Unlike the Dinaledi's sponsorship package, the benefits entailed within the Uganda GSBUSP package include meals, accommodation, faculty allowance and tuition fees. The current study, therefore, sought to establish if

A-Level girls' awareness of such sponsorship benefits entailed within the Uganda GSBUSP influence their performance in science at A-level.

In Malawi, Gomile-Chidyaonga (2003) found that the university science-based sponsorship policy, which involves paying lecturers to provide extra tuition and support to girls who enter the STME programmes on a slightly weaker footing than boys, has resulted into better performance. Similarly, in Tanzania (Masanja, 2001) and Kenya (Bunyi, 2009), sponsoring remedial courses in science and mathematics for borderline female candidates was found to improve their performance greatly. In Tanzania for instance, Masaja (2001) reports that some of the remedial programme entrants were found to be performing better than their direct entry male and female peers in the assessment examinations administered to the 1999/2000 3rd year Bachelor of Science program cohort of students.

In California, however, sponsorship of student-centered classes, enrichment activities, and academic and financial counseling for middle and high school students in Mathematics, Engineering, and Science Achievement (MESA) did not improve the participants' grades. Despite this failure, both the female and male beneficiaries continued to take advanced mathematics and science courses because their confidence and perseverance in these courses had been increased by the sponsorship (California Post-secondary Education Commission, 2006).

## 2.5 Chapter Summary

The reviewed literature reveals that in some countries such as in the USA, Tanzania, Kenya and Malawi, girls' increased participation in sciences was promoted by science-based sponsorship policies with a positive discrimination for girls. The findings on these policies do not tell whether a science-based sponsorship policy with no consideration for girls like the Uganda GSBUSP can promote girls' participation in the sciences. The success of the science-based sponsorship policies in the aforementioned countries was reinforced by other existing science based affirmative action provisions that also support girls' education in the sciences. For instance bridging courses in Kenya and Tanzania and extra tuition sessions in Malawi enabled borderline female candidates to qualify and study the competitive science based university courses successfully. However, the Uganda GSBUSP does not have such additional affirmative action provisions in its implementation. It is also in this context that this study sought to establish if a science-based sponsorship policy without such pro-girls' affirmative action support provisions can significantly increase girls' participation in the sciences.

In South Africa, however, a gender blind science-based sponsorship policy whose package involved the affirmative action of equipping disadvantaged Secondary schools with science kits and in-service training of teachers in their use promoted girls' performance in the sciences. Unlike that of South Africa, Uganda's gender blind GSBUSP's package entails providing fees waivers to students eligible to study science related university courses. The evaluation

findings of the impact of South Africa's gender blind policy on girls' participation in the sciences cannot be applied to Uganda's GSBUSP because of the difference in their sponsorship package. Hence the need to establish if a gender blind science-based sponsorship policy which entails providing students eligible to offer sciences at university level with fees waivers like those in the Uganda GSBUSP has an impact on girls' participation in the sciences at A-level.

The Uganda government science-based university sponsorship policy that was instituted in 2005 increased the number of sponsorship slots for science students, but with no provision of a positive discrimination for girls. The influence of Uganda's gender blind GSBUSP on girls' participation in the sciences at A-level has never been investigated. It is also on this basis that the study sought to investigate the impact of this policy on girls' participation in the sciences.

## CHAPTER THREE

### RESEARCH DESIGN AND METHODOLOGY

#### 3.1 Introduction

In this chapter, the researcher presents and discusses the methodology that was used to investigate the problem of the study. The chapter is organised into sub topics which include research design, study variables, study location, target population, sampling procedures, instrumentation and procedures of data collection and analysis.

#### 3.2 Research Design

The Ex-Post-Facto design was used in this study because the investigation involved comparing two pre-existing groups on the same dependent variable (Lammer & Badia, 2005). The dependent variable in this study was the anticipated increase in girls' participation in the sciences at A-level. The Ex-post-facto design permitted the researcher to compare the impact of the policy on girls' and boys' participation in the sciences at A-level as the two pre-existing groups that were exposed to different experiences in this field. Boys were the historically advantaged group in the sciences while girls were the disadvantaged group.

##### 3.2.1 Study variables

According to Nachmias and Naichmias (1990, p 56) and, Dixon, Bouma and Atkinson (1995, 5p. 1) a variable is “a concept that varies in amount or kind.” Nachmias and Nachmias, (1990, p56) further state the “variable the researcher wishes to explain is the “dependent variable” and the one expected to explain

the change in the dependent variable is the “independent variable”. In this study, the Uganda Government Science-Based University Sponsorship Policy (GSBUSP) was the independent variable, while girls’ participation in the sciences at A-level (GPSs) was the dependent variable. The Uganda, GSBUSP variable was considered in terms of the faculty allowance (FA) and the various fees waivers for meals, accommodation, and tuition. The indicators for participation were girls’ and boys’ awareness of the Uganda GSBUSP, the number of girls and boys who enrolled in the sciences at A-level, and the number of girls and boys who performed well in the sciences at A-level.

### ***3.2.2 Research methodology***

The investigative approach for the study objectives was specifically guided by null hypotheses oriented towards controlling as many extraneous variables as possible (Odiya, 2009). Testing hypotheses involves the collection of numerical data in order to explain predict and control phenomena of interest with the data analysis being mainly statistical (Amin, 2005). Thus the Ex-post-Facto design in this study mainly employed quantitative research techniques. The researcher was, however, cautious of the fact that quantitative results, especially in the social sciences where human beings are the subject of study do not necessarily explain cause and effect, , as would be the case in the other sciences. . In this study, the task was to establish the descriptive data that explained the relationships and processes behind the numerical data (Naichmias & Naichmias, 1990). Therefore, the use of mixed methods approach in this study was for supplementing and triangulating findings, thus making interpretations richer and deeper (Babikwa, 2003).

### **3.3 Location of the study**

It was conducted in Wakiso and Mukono districts in central Uganda. Wakiso district surrounds Kampala and borders Mukono in the East, Mubende and Mpigi in the West, Luwero in the North and Kalangala in the South. Mukono district borders Jinja district in the East, Kayunga district in the North, Wakiso in the West, and Kalangala in the South (See Appendix XIII for the location of the two districts in the map of Uganda). These two districts were specifically selected because they have most of the characteristics that are of interest to the study. Both have the highest number of A-level science students in secondary schools in Uganda (MoES, 2009). More than half of the state scholarships in the public universities are taken by schools in Wakiso and Mukono districts (Ahimbisibwe, 2009a). These two districts are top of the list of the 10 ranked districts in the country that send the highest number of students, science students inclusive, to public institutions of higher learning (Ahimbisibwe, 2010). In addition, Wakiso and Mukono districts also house most of Uganda's well established public secondary schools in terms of facilities, enrolment and performance, and a long history of participation in A-level sciences (MoES, 2008). These characteristics were important for this study, making these two districts suitable for the study.

### **3.4 Target Population**

Amin (2005) recommends that a researcher declares the target population from which the study sample is taken. The total target population for this study was 2,760 and it involved seven categories of respondents. The main category of respondents was A-level students who studied sciences in the selected

government secondary schools in the two districts in 2011. The A-level students' target population was, 242. This total population was a sum of 413 A-level girls and 829 A-level boys who studied the sciences at A-level in secondary schools in Mukono and Wakiso districts in 2011 (Uganda Bureau of Statistics, 2011). The A-level science students (girls and boys) in the selected schools provided their personal views and experiences in relation to the extent to which their awareness of the Uganda GSBUSP had contributed to their participation in the sciences. Establishing the A-level students' views on the policy's impact on their choice to enrol for the sciences at A-level was the concern of this study. Although the sponsorship policy targets university students, their decision to choose either the sciences or the Arts is made at A-level.

The Science Teachers (ScTrs), Science Students (SSs), Career Teachers (CTrs), Directors of Studies (DoS) and Parents (PRs) of girls and boys taking the sciences at A-level were identified as key informants in this study. The other categories of participants included to provide information for the study were Head Teachers (HTrs), District Inspectors of Schools (DISs), and MoES officials.

The target population of the other categories of respondents included 37 head teachers, 37 directors of studies, and 37 careers teachers from the 37 government A-level secondary schools that offer sciences in the two districts. From these target schools, a target population of 148 science teachers were considered because each school was supposed to have at least one science teacher for each

of the four A-level science subjects. A target population of two district inspectors of schools, one from each of the two districts and of 1,242 parents was considered in this study. The parents' number was based on the students' target population. Only one parent was expected to be considered even in a case where two parents of the same student were met. This was because it was important to give parents from many households the opportunity to participate in the study as opposed to having fewer homes in the study. In addition, a target population of 15 MoES officials were considered in this study.

### **3.5 Sampling Techniques and Sample Size Determination**

#### ***3.5.1 Sampling schools***

In this study, purposive sampling technique was used to select six A-level senior secondary schools. Purposive sampling is a type of non-probability sampling, which involves the selection of a sample that has characteristics that are desired in the study population (Adèr, Mellenbergh & Hand, 2008). This technique was used because the researcher needed to collect data from student respondents from schools with two important characteristics that were considered necessary for providing relevant data for the study. These characteristics included the type of the school (boys, girls and co-educational) and the number of years the school had offered science subjects at A-level. These characteristics would have been lost if a more generalised sampling technique was used for selecting the study sample schools (Bell, 1993; Mugenda & Mugenda, 1999). Only secondary schools that had offered sciences at A-level for at least 5 years before and after the inception of the policy were

sampled for the purpose of collecting data on students' enrolment and performance before and after the inception of the Uganda GSBUSP.

Co-educational and single sex schools were sampled in this study because the researcher was cognizant of the arguments amongst some scholars that single sex schools increase girls' participation in the sciences (Kwesiga, 2002) while others believe otherwise (Stromquist, 1992).

During the process of data collection, there was change in the sample size of the schools. Originally, it had been planned that data would be collected from a total of 24 schools. From this total, 12 would be private schools while the other 12 would be government-funded. During the reconnaissance visits to the study sites before actual data collection, it was established that there were no private secondary schools in the study area that had the desired characteristics of the research. This left the researcher with only 12 government schools to be considered for the study. From the 12 government schools, it was also established that four of them had just started offering science subjects at A-level and so could not offer any data for the pre-policy era. This left the study with only eight schools from which to collect data.

From the eight schools, two were co-educational; two were boys' secondary schools, while four were purely girls' secondary schools. These schools were equally distributed in the two districts. In a bid to have an equal number of the different school categories in the study sample, only two of the four girls' schools were randomly selected, bringing the final number of schools used in

the study to six. The summary of the schools in their categories that were sampled is shown in Table 3.1.

**Table 3.1 Sampling frame for selecting Government secondary schools for the study**

<b>Nature of School</b>	<b>Wakiso</b>	<b>Mukono</b>	<b>Grand Total</b>
Boys	1	1	2
Girls	1	1	2
Co-educational	1	1	2
<b>Grand Total</b>	<b>3</b>	<b>3</b>	<b>6</b>

### **3.5.2 Sampling questionnaire participants**

#### a) Students

Students were selected using the Simple Random Sampling (SRS) method. This method is an Equal Probability of Selection (EPS) design that gave every student an opportunity to participate in the study (Ader, Mellenbergh & Hand, 2008). According to Etter & Pernerger (2000), study results from an EPS design sample are generally considered valid for generalisation to the study population.

In each of the co-educational schools, science students were first stratified into two categories girls separate from boys. After the separation, 10 boys and 10 girls were then randomly selected from each of the groups using the lottery method. In the case of single sex schools, 30 science students were also selected from the scientific group using lottery method. Therefore, a total of 160 A-level science students (80 boys and 80 girls) participated in answering the questionnaire. This sample size was 12.9% of the target population of 1,242

A-level science students enrolled in government secondary schools in Mukono and Wakiso districts in 2011. This students' sample size is within the acceptable range for a survey study. A sample size of 160 is sufficient to yield useful results that can be generalised to a target population of 1,242. Emory (1985) recommends that a sample size required for a survey should be at least 10% of its target population. He is supported by Ruddick, Sherwood and Stevens (1983) who say that a sample size between 100 and 200 is useful for exploring variations within a total population of 1,000 -1,500. Eldred (1987) suggests that quantitative studies' samples of 100-200 persons are sufficient to yield useful results because one obtains diminishing results when the sample size increases beyond 300. O'Keefe (2007) and Yamane (1967) also recommend that a sample size of not less than 80 participants is preferred for a correlation study.

#### **b) Directors of Studies**

These were purposively sampled because their post is held by single individuals who have the information desired for the study. Using the purposive sampling technique with these participant was consistent with Trochim's (2006) recommendation that it be used where we have more specific predefined groups from which we sample with a purpose in mind. A sample size of six Directors of Studies (DoS) was selected for the study in equal representation of the six schools in the study. Each DoS was selected to fill in the questionnaire, which sought to establish students' enrolment and

performance in senior six science subjects before and after the inception of the Uganda GSBUSP.

### ***3.5.3 Sampling students for the FGDs***

Students who participated in the FGDs were selected using the Simple Random Sampling (SRS) method because this method is an equal probability of selection (EPS) design. This sampling technique gave every student an opportunity to participate in the study (Ader, Mellenbergh, & Hand, 2008).

Some scholars have advised that a typical focus group should consist of 6-10 or 6-15 individuals (Hoyle, Harris, & Judd, 2002). Their explanation for this group size is that fewer than six may make it difficult for the desired diversity of opinions to be elicited, while more than ten may make it difficult for everyone to express their opinion fully. Other writers have, however, given a range of from as small as four to as large as twelve persons (Marshall & Rossman, 1989). In this study, eight focus group discussions were held in the six secondary schools that participated in the study. A total of 56 senior six science students (32 girls and 24 boys) participated in the focus group discussions. In each co-educational school 2 focus groups were formed; one for girls and the other for boys. In single sex schools only one focus group discussion was held. The girls' FGDs comprised of eight members while the boys' FGDs had six members. These focus group sizes allowed everyone to express their opinion fully within the available time of one hour that was given to the researcher to interact with the students in each of the schools visited.

#### ***3.5.4 Sampling participants for individual interviews***

According to Boyce & Neale (2006) the sample size for interviewees is only big enough when you hear the same information from a number of stake holders. Therefore, the sampled size of interview participants may increase when need for supplementary information arises during the data collection process, or decrease when the same information is emerging from the sampled interviewees before interviewing all of them. In this study therefore, though the planned sample size of participants for the individual interviews was 70, the interviewees' sample size was neither fixed nor was their percentage used for projection purposes.

##### **(i) Parents**

In this study, the purposive sampling technique was used for selecting parents because they were selected more for their validity than for their representativeness. A parent was included in the study sample when he/she: had a child studying sciences in S.6 in 2011, was knowledgeable about the study problem, and was willing to participate in the study. The Purposive sampling technique was also used in the convenience sampling of parents in order to ensure that the study sample consisted of both genders (Adèr, Mellenbergh, & Hand, 2008). Perspectives from the two genders provided a variety of ideas about the study problem (Trochim, 2006). An initial total sample size of 36 parents out of a target population of 1,242 was selected to participate in the interview sessions, six from each school. According to Carman (2004) the intensive nature of interviews warrants having a smaller sample size of interviewees. However, during the process of data collection,

the sample size of parents interviewed raised by four in order to generate additional information required to fill in the study gaps that emerged in the process of data analysis. This made the parents' total sample size rise to 40 from 36.

**(ii) Science teachers**

Each of the four science subjects offered at A- level, namely Physics, Chemistry, Biology and Maths has at least one teacher. At least two science teachers were conveniently sampled from each of the selected schools. The initial total sample size of science teachers selected for this study was 12. During the process of data collection, two more male science teachers from two different schools were added to the study, increasing their sample size from 12 to 14. The sample size of the teachers interviewed was raised in order to generate additional information required to fill in the study gaps that emerged in the process of data analysis. During the sampling of teachers, purposive sampling was used in order to ensure that the study sample consisted of both genders and teachers with a long period of service in the respective schools. Use of views from both genders ensures balanced responses (Adèr, Mellenbergh, & Hand, 2008). Teachers with a long period of service were in position to explain provided a variety of ideas about the study problem in relation to the two policy eras.

**(iii) Administrators at various educational levels**

Ten education officers used in this study were purposively selected and these included: Two MoES officials, six Head teachers (HTrs), and two District Inspectors of Schools (DISs). These categories of respondents were

purposively sampled because their posts were held by single individuals who had the information desired for the study. Thus, using the purposive sampling technique was in agreement with Trochim (2006), who recommend sampling purposely where we have more specific predefined groups from which we sample with a purpose in mind.

**Table 3.2 Distribution of the sample population across categories**

Category	Target Population	Sample Population	Percentage	Sampling Strategy
Students	1,242	216	17.4	Simple random sampling
Parents	1,242	40	3.2	Purposive Sampling
Science teachers	148	14	9.4	Purposive Sampling
Head teachers	37	06	16.2	Purposive Sampling
Careers' teachers	37	06	16.2	Purposive Sampling
Directors of studies	37	06		
District inspectors of schools	02	02	100.00	Purposive Sampling
MoES officials	15	02	13.3	Purposive Sampling
<b>Total</b>	<b>2,760</b>	<b>292</b>	<b>10.6</b>	

### 3.6 Research Instruments

In this study, data was collected using self-administered questionnaires, interview guides, and an observation checklist. Use of a variety of instruments facilitated triangulation of data (Altrichter, Felman & Somekh, 2008; O'Donoghue & Punch, 2003) so as to enhance validity of the study (Gay, 1996) and for collecting comprehensive data.

#### 3.6.1 Questionnaires

Self-administered questionnaires were only administered to students and directors of studies mainly because the information for the measurable variables that were being targeted by the study could only be supplied by the students and directors of studies. Consequently, only two sets of questionnaires

were designed for these two categories of respondents. In the director of studies' questionnaire, the study variables included: the number of senior six students who enrolled and obtained high and low scores in the sciences. These variables needed to be collected carefully in written form for future statistical analysis (Carman, 2004).

Questionnaires were also deemed suitable for collecting students' motives, views, perceptions and reactions towards the topic of the study (Gay 1996; Marshall & Rossman, 1989). In the students' questionnaire, the study variables included: students' awareness of the Uganda GSBUSP, students' scores in A-level science mock examinations, and students' opinions on the relationship between awareness of the Uganda GSBUSP and their choice to enrol for the sciences and performance in the sciences.

The students' questionnaire was closed ended because the use of a standardised instrument was appropriate for providing equalising conditions for the two groups to be compared. In this way girls and boys all considered the same universe of content (Amin, 2005). The students' questionnaire contained only structured question items. All the structured questions had categorical response choices of either 'yes' and 'no' or 'agree' and 'disagree' and a technique of 'ticking the right choice', which is familiar to most students, was used (see Appendix I for details of the data collection items in the questionnaire).

Secondly, the students' sample size in this study was quite large (160 students). Hence, a closed ended questionnaire was the best instrument in this case because studies with many respondents often use shorter, highly structured

questionnaires (Carman, 2004). Third, owing to time and resource constraints, a closed ended questionnaire was the most ideal tool for collecting vast amounts of data from students in a relatively short time (Amin, 2005). In addition, since students are literate, it was much easy to use a questionnaire to collect much information in a short time from busy students. Furthermore, the quantitative data that emerged from the questionnaires helped to establish statistical patterns of the issues under investigation, thus providing outcome data as a context for the collection of other qualitative data through interviews (Boyce & Neale, 2006).

### ***3.6.2 Individual Interview Guides***

In this study, the individual interview guides consisted of a list of questions under different themes that were asked during the interviews to elicit data from the interviewees (Odiya, 2009). In this context therefore, the interview guides were used for conducting semi-structured interviews. The interview guides were important tools in this study for collecting in-depth information from parents, head teachers, directors of studies, science teachers, District Inspectors of Schools and students. Semi-structured interviews complemented quantitative data from the students' closed ended questionnaire so as to offer a more complete picture of the phenomenon under investigation (Boyce & Neale, 2006). Additionally, semi-structured interviews allowed the researcher to follow up a respondent's answers to obtain more information and clarify vague statements (Meredith, Borg & Joyce, 1996). This aspect gave the semi-structured interviews an edge over the questionnaire because it was practically impossible to make adjustments as and when the need arose in the field.

### **3.6.3 Focus Group Discussion Guide**

The Focus group discussions were guided by an interview guide with broad questions directed towards eliciting information on the study's research problem. The question items in the focus group discussion guide were related to the objectives of the study. Focus group interviews used group interaction to produce data and insights that would have been less accessible without the interaction found in a group (Morgan, 1988, p. 122). In this study, the focus group interview guide enabled the researcher to collect varied and well explained opinions of the students about the research problem. Such elaborate and varied views of the focus group participants could not be captured by the self-administered questionnaire which was predominantly composed of closed-ended question items.

### **3.7 Piloting the Study and Pre-testing the Instruments**

A pilot study is a small-scale rehearsal of a larger data collection process (Odiya, 2009). In this study, the pilot study involved pre-testing the instruments for the following reasons. First, this helped the researcher to identify any ambiguities, misunderstanding or inadequacies in the instruments. It has been argued that without pre- testing, it is simply impossible to anticipate all the ambiguities, difficulties that the wording, presentation, and order of the questions will present as a whole (Gyekye, 2001; Amin, 2005). Second, through the pre-test, the researcher was able to determine how long it may take participants to complete the questionnaire or answer the interview guide questions, establish whether respondents interpreted the questions correctly in view of the information that was required, and to check if the respondents

understood the instructions. Third, pre-testing was also used for checking and strengthening the validity and reliability of the instruments (Bell, 1993).

The pilot study was carried out in Kampala and Jinja districts. Though the pilot study was initially supposed to be carried out in Kampala district only, it did not have a single boys' A-level school. Consequently, the researcher had to pick a boys' A-level secondary school from Jinja district. The pilot study was done in Kampala and Jinja districts because they had schools with characteristics similar to those of the two districts of the study- Mukono and Wakiso. The pilot study puts into consideration the different government school settings of single and co-educational schools and the school's long history of participating in the sciences at A-level going as back as 1999. The pre-test of the instruments was done in three government schools. The researcher pre-tested the questionnaire using a sample of 24 senior six (S.6) science students, eight from each school. The number of 24 pilot study participants is above the 20 respondents recommended for pilot testing quantitative study questionnaires (Osborne & Waters, 2002). The rationale for using A-level science students in single and co-education schools was to ensure that the sample group used to pre-test the questionnaire had similar characteristics to those of the study participants. The Interview guides and the Director of Studies (DoS) questionnaires were also pre-tested in the three (3) pilot study schools using a sample of one parent, head-teacher, science teacher and one director of studies per pilot school, and one district inspector of schools. In addition, focus group discussions with 32 students that were

initially not planned for were also conducted in the pilot study in order to pre-test the focus group discussion guide as well. The need to get in-depth explanations from students on the study's problem was highly recommended as necessary by the experts who rated the researcher's instruments. This is because the elaborate and varied views generated in focus group discussions could not be captured by the self-administered questionnaire which was predominantly composed of closed-ended question items. Thus, a total of 79 study sample participants were used in the pilot study.

### ***3.7.1 Validity of instruments***

Validity refers to the extent to which an instrument measures what it is designed to measure (Ary, Jacobs & Razaveh, 2002). Subjects are less likely to complete and return questionnaires perceived to be inappropriate. Therefore, the instrument should have face validity, simple wording and clarity (Glukha, et al., 2003). The content validity of the questionnaire and interview guides was established by conducting an item analysis. This was done with the assistance of ten experts, academic staff of Kyambogo University, who were competent in research methodology. Purposive sampling was used to select these persons. The persons identified vague or irrelevant items and modified them. The content validity of the questionnaire was computed for each of the items using the formula adopted from Amin (2005):

$$CVI = \frac{\text{Number of times an item is rated as relevant}}{\text{Total number of raters}}$$

After the reviewers had rated the items, content validity for the different sections was computed. All items that had the validity of .70 and above were

considered. Those items that had the CVI of less than .70 were dropped as invalid items since they were below the CVI lower limit of .70 and they were generated information that was invalid for the study (Amin, 2005).

In addition, during the pilot study, the researcher encouraged the respondents to ask for clarifications on questions which they did not understand. The researcher took note of the questions which they did not understand and later either re-worded or deleted such questions. This process helped to sharpen the questions, thus strengthening the validity of the tools. Also, during the pilot, the section with the open ended items in the student questionnaire was established to be redundant and was deleted in the final instrument. This section was recommended by experts for deletion since information from it was being obtained from the FGDs.

### ***3.7.2 Reliability of the instruments***

Reliability refers to the consistency of an instrument to yield the same results at different times (Frankel & Wallen, 1993; Amin, 2005). A reliable instrument ensures that participants provide information to items that are clear. In this study, the students' questionnaire's reliability was established through a test-retest technique, which provided information that was used to calculate the reliability of the sections in the questionnaire. The test-retest exercise on the questionnaire was carried out during the pilot study. The questionnaire was pre-tested using a total of 24 student respondents to whom the same questionnaire was administered twice, at an interval of a two weeks' period. The overall content reliability of the sections in the questionnaire was assessed

using the test-retest method during the pilot study. Pearson Product Moment Correlation Coefficient in the computer SPSS program was used to calculate the reliability so as to establish the Correlation coefficient for each section. Sections whose Correlation coefficient was above .8 were considered reliable (Osborne & Waters, 2002).

Internal consistency of the items was computed so as to determine the extent to which the content of the questionnaire was consistent in eliciting the same responses when administered at different times to the same group (Amin, 2005). Cronbach's Alpha Coefficient was used to compute the internal consistency of the instrument. When the Alpha coefficients of the sections were over .8, it meant that they had internal consistency (Osborne & Waters, 2002). The Alpha Coefficients of the sections in the student questionnaire used in this study were calculated. The sections that had coefficient of less than .8 were revisited and a second test was done focusing on them. In the end, all the sections had reliability coefficients above .8.

### **3.8 Data Collection Procedure**

The fieldwork for this research started in May, 2011. On the first day of the research, the researcher went to the office of the Commission in-charge of Secondary Education in the Ministry of Education and Sports, Kampala-Uganda to request for permission to conduct research in the secondary schools of interest. The researcher used the research permission letter from Kenyatta University Graduate School to seek permission to carry out her study from the Ministry of Education and Sports in Uganda. A permission letter from the

Commissioner of Secondary Education was used to approach the District Inspectors of schools and the sampled schools in the districts of the pilot and final study. Collection of the primary data for this study was preceded by a pre-test of the research instruments in August, 2011. The pilot study process for pre-testing the instruments was conducted in August, 2011 instead of in June, 2011. This was due to two reasons. The process of getting written permission from the Ministry of Education and Sports (MoES) took longer than was anticipated (from May till June 2011). Secondly, in July, 2011, all the secondary schools were conducting mid-term examinations, which engaged both students and teachers. The school administrators thus advised the researcher to pre-test the instruments in August, 2011. The study instruments were then pre-tested in August and September 2011. After, the researcher fine-tuned the instruments and trained two research assistants on how to use them so as to collect the definite data required for this study.

After refining the instruments, the researcher and her research assistants went to the two districts and their respective secondary schools specified in this study for actual data collection. During these visits, the researcher and the research assistants introduced themselves to the school authorities and made arrangements on how and when to administer the research instruments. On arrival to the selected schools, the researcher first sought audience with the school administrators, gave them the MoES written permission to collect data.

In all the six schools, the head-teachers introduced the researcher to the director of studies, who in turn introduced her to the Careers teachers, S. 6

science class teachers and science teachers. The S.6 science class teachers in turn introduced the researcher and her research assistants to the S.6 science students. While in the schools, the researcher conducted individual interviews with science teachers, careers teachers, head-teachers and parents. The research assistants conducted focus group discussion interviews with students and administered students' and director of studies questionnaires.

Tape recording was done for the storage of data before transcription and data analysis. The recording was done with the participants' permission.

### ***3.8.1 Questionnaire for students***

In the case of the S.6 students, class teachers of the different classes were requested to help in assembling the students, distributing and retrieving the questionnaires from identified students. In each school, before sampling the students to answer the questionnaires, the researcher and the research assistants met the students and talked to them about the research to set a good rapport environment with them. The researcher and the research assistants then randomly sampled students and took them to a hall or science laboratory where there was no distraction or noise. Questionnaires were then distributed to the respondents who were given 45 minutes to answer them after which the research assistants collected the questionnaires.

### ***3.8.2 Focus Group Discussion Interviews***

The focus groups discussions were guided by an interview guide. In as much as possible, the researcher encouraged each and every participant in the focus group to speak out freely, while being careful as cautioned by Kakuru (2006)

to discourage domination of discussions by a few individuals in the group. All the proceedings of the focus group discussions were tape recorded with permission from the respondents. Tape recorders were used to capture all the necessary information from the interviews. These recordings were transcribed and analyzed by the researcher at the end of each day in which the focus group interviews were held. This process enabled the researcher to modify some of the questions to be asked in the next discussion sessions. This is because, as observed by Glesne and Peshkin (1992), after a focus group session, new understanding may emerge, which requires new questions.

### **3.8.3 *Individual Interviews***

Individual interviews were conducted with parents, District Inspectors of schools, science teachers, careers' teachers, head teachers, Directors of studies and Ministry of Education & Sports officials. Appointments for interviews with the respective interviewees were made through earlier visits. Parents who were willing to be met in the schools were interviewed on visitation Sundays, while the others were interviewed at their work places. Data from these informants were collected using individual interview guides. The individual interviews involve conducting intensive individual interaction with participants from the above mentioned categories of the study sample so as to explore their perspectives on the impact of the Uganda GSBUSP on girls' and boys' participation in the sciences at A-level (Boyce & Neale, 2006).

### **3.9 *Data Analysis***

The data analysis exercise involved reducing and organizing the body of raw data from the field into categories aimed at producing results that could be

interpreted by the researcher. Quantitative and qualitative methods of data analysis were used in this study.

### ***3.9.1 Quantitative Data Analysis***

Quantitative data were generated from the students' and Directors of Studies' responses to the structured questionnaire items. To begin with, manual data processing was done. This involved checking and analysing all the questionnaires one by one for completeness and consistency. After that, the data were entered into the computer SPSS package. This software was chosen because it creates data entry screens, which look like the hard copy of the questionnaire. In addition, it allows the creation of consistency checks that helps to eliminate out of range errors of the data entry.

Frequency counts, percentages, averages and bar graphs were used to descriptively present and explain the data on the differences between the number of girls and boys who enrolled and performed well in the sciences at A-level before and after the inception of the GSBUSP, and their responses in terms of the policy's relationship to their enrolment and performance in the sciences at A-level. All the null hypotheses tested in this study were generated from this descriptive data. According to Tukey (1993), in quantitative data analysis, emphasis needs to be placed on using data to suggest hypotheses to be tested.

Objective one sought to establish the differences in the number of girls and boys enrolled in the sciences before and after the inception of the GSBUSP.

The hypothesis for objective one stated that:

*H<sub>1</sub> Girls enrolment in the sciences at A-level before and after the inception of the government science-based university sponsorship policy is significantly lower than that of boys.*

Data for hypothesis one was analysed using a *t-test* for independent groups in the following null hypotheses:

*Ho1 There is no significant difference between the mean number of girls enrolled in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance.*

*Ho2 There is no significant difference between the mean number of boys enrolled in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance.*

*Ho3 There is no significant difference between the mean number of girls and boys enrolled in the sciences at A-level before the inception of the Uganda GSBUSP at .05 level of significance*

*Ho4 There is no significant difference between the mean number of girls and boys enrolled in the sciences at A-level after the inception of the Uganda GSBUSP at .05 level of significance*

In each of the above null hypotheses, if the p value was greater than .05, then the mean enrolment numbers were not significantly different. If the probability was less than, or equal to .05, then the mean enrolment numbers were significantly different.

The hypothesis for objective two stated that:

*H<sub>2</sub> Girls' awareness of the Uganda GSBUSP is not significantly related to their choice of the sciences at A-level as compared to that of boys.*

Objective two sought to establish the relationship between girls' and boys' awareness of the GSBUSP and their choice to enrol for science subjects at A-level. It is on this basis that the following specific null hypotheses were formulated and used to test the data generated for hypothesis two ( $H_2$ ) using Pearson Product Moment Correlation Coefficient ( $r$ ):

*Ho5 There is no significant relationship between girls' awareness of the Uganda GSBUSP and their choice of the sciences at A-level at .05 level of significance.*

*Ho6 There is no significant relationship between boys' awareness of the Uganda GSBUSP and their choice of the sciences at A-level at .05 level of significance.*

In the above null hypotheses, if the p value was greater than .05, then the variables were not significantly related. If the probability was less than, or equal to .05, then the variables were significantly related.

The hypothesis for objective three stated that:

*H<sub>3</sub> The mean number of girls who performed well in the sciences at A-level before and after the inception of the Uganda GSBUSP is not significantly different from that of boys.*

Objective three sought to establish differences in the number of girls and boys who performed well in the sciences before and after the inception of the GSBUSP. Thus, *at-test* for independent groups using the following specific null hypotheses was used for analysing the data for objective three:

- Ho7 There is no significant difference in the mean numbers of girls who obtained 2PPs and above in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance*
- Ho8 There is no significant difference in the mean numbers of boys who obtained 2PPs and above in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance*
- Ho9 There is no significant difference between the mean numbers of girls who performed well in the sciences at A-level before the inception of the Uganda GSBUSP compared to that of the boy's at .05 level of significance*
- Ho10 There is no significant difference between the mean numbers of girls who performed well in the sciences at A-level after the inception of the Uganda GSBUSP compared to that of the boy's at .05 level of significance*

The following specific null hypotheses were used to test the above hypothesis.

The hypothesis for objective four stated that:

- H<sub>4</sub> Girls' awareness of the Uganda GSBUSP is not significantly related to their performance in the sciences at A-level as compared to that of the boys.*

Data for hypothesis four were analysed using Pearson Product Moment Correlation Coefficient. In the correlation analysis, the scores on students' Uganda GSBUSP related to reasons for working hard to excel in the sciences at A-level were correlated with the actual student grades obtained in the A-level science mock examinations. In the correlation analysis, the following specific

null hypotheses were used to test the above hypothesis for objective four ( $H_4$ ) using Pearson Product Moment Correlation Coefficient (r):

*Ho11 There is no significant relationship between girls' awareness of the government's science-based university sponsorship policy and their performance in the sciences at A-level at .05 level of significance.*

*Ho12 There is no significant relationship between boys' awareness of the Uganda GSBUSP and their performance in the sciences at A-level at .05 level of significance.*

In the above null hypotheses, if the p value was greater than .05, then the variables were not significantly related. If the probability was less than, or equal to .05, then the variables were significantly related.

### **3.9.2 Qualitative data analysis**

Qualitative data was categorised into themes and sub themes in relation to study objectives using the thematic method of analysis. In this study, the analysis of qualitative data began at the data collection stage and continued up to the time of writing the final research report as recommended by Robson (2002). At the end of each day, the researcher transcribed all the tape recorded individual and focus group interviews according to the different respondents and schools. This helped in the development of themes and other emerging issues, which were later used for discussion in the thesis.

The transcribed data were analysed to capture the major themes which were organized in line with the study objectives (Carson, et al, 2001). This involved summarising all the qualitative data thematically in line with the objectives.

Qualitative responses were used as complementary information to some of the findings established in the statistical analysis. Excerpts from interviews with participants were used to represent their voices in the study. In addition, some of the qualitative data were used to validate some of the findings from the quantitative data. This data analysis process was particularly enriching because through it, the researcher further ensured the quality of the data and was also able to identify areas that needed emphasis.

### **3.10 Ethical Considerations**

According to Resnik (2011), ethical lapses in research can significantly harm human and animal subjects. Hence, several ethical considerations were made in this study in order to protect the human rights and welfare of the participants. The researcher operated within the ethical considerations of research on human subjects which require that informants be assured of confidentiality of the information given to the researcher and her assistants (Whelan, 2007). Participants were thus told explicitly how their confidentiality and anonymity was going to be maintained as recommended by Grbich (1999). All the interviewees in the study were informed that during the transcription phase, pseudonyms would be allocated to them consequently, during the transcription of the interviewees' responses, the researcher arbitrarily selected the pseudonyms for schools used in the study and the respondents were named according to their categories. For example, individual science teachers were named 'Female ScTr'/'Male ScTr', careers teachers were named 'Male CTr'/'Female CTr', head-teachers were named 'Male HTr'/'Female Htr', district inspectors of schools were named 'Male DISs' and Ministry of

Education and Sports officials were named 'Male/ MoES Official'/ Female MoES official. The two girls' Senior Secondary Schools were re-named as Akwali Girls' SSS and Akwar Girls' SSS respectively. The two boys' Senior Secondary Schools were re-named as Ogudu Boys' SSS and Okodi Boys' SSS, while the Mixed Secondary Schools were re-named as Aguzu mixed SSS and Ngoi mixed SSS. The two districts were re-named as Bati and Oketi. Anonymity of the participants who filled in the questionnaires was ensured by excluding the provision for name of respondent in the demographic section of the questionnaire.

Furthermore, the following ethical considerations as recommended by Driscoll & Brizee (2012) for primary research were implemented in this study. The purpose for which data was being collected was explained to the respondents to allay any fears that may have arisen from the exercise. Efforts were made to ensure the provision of an environment that allowed participants to respond willingly and voluntarily without feeling threatened. Informed consent before involving the respondents in the study and requesting respondents to kindly participate in the study sought. Only those who gave their consent to participate were involved in the study. Lastly, when the research is finalised, the findings will be made available to the respondents as a way of giving them feedback.

### **3.11 Logistical considerations**

The study was conducted using the budget allotted to it. The funds were availed through Kyambogo University Staff Development Research Fund. The

researcher also acquired relevant research clearance as required by the Government of Uganda and MoES protocols currently in force. A research clearance to conduct research was obtained from Kenyatta University while a research permit was obtained from the MoES in Uganda.

## CHAPTER FOUR

### DATA PRESENTATION, ANALYSIS AND DISCUSSION

#### 4.1 Introduction

The chapter presents study findings and the data analysis, interpretation and discussion. The findings are organised according to the logic of study objectives which include; comparing the number of girls and boys that enrolled and performed better in the sciences in the two policy eras and establishing the relationship between girls' and boys' awareness of the policy and their choice to enrol and perform better in the sciences at A-level. The characteristics of the study participants precede the presentation of the actual findings for purposes of revealing contexts. It is on this basis that the chapter first presents demographic information on the participants' sample size and their characteristics in relation to the district of origin, gender and socio-economic background.

#### 4.2 Demographic Information

##### *4.2.1 Characteristics of the participants*

The distribution of participants in the sample districts of Mukono and Wakiso is depicted in Table 4.1. It should be noted that two officials from MoES who are included in this study sample are not from the two districts. They have been added at the bottom of Table 4.1 making the total sample of participants to be 292 instead of 290.

**Table 4.1: Distribution of categories of participants in the sample districts**

Category of Participants	Districts				Grand Total	
	Mukono		Wakiso			
	Frequency	%	Frequency	%	Frequency	%
Students	108	37.0	108	37.0	216	74.0
Parents	20	6.9	20	6.9	40	13.8
Science teachers	6	2.1	8	2.8	14	4.8
Career teachers	3	1.0	3	1.0	06	2.0
Head teachers	3	1.0	3	1.0	06	2.0
Directors of studies	3	1.0	3	1.0	06	2.0
Inspectors of schools	1	0.3	1	0.3	02	0.7
MoES Officials					02	0.7
<b>Totals</b>	<b>144</b>	<b>49.3</b>	<b>146</b>	<b>50.0</b>	<b>292</b>	<b>100</b>

*Source: primary questionnaire data (2011)*

Table 4.1 shows that Wakiso district produced half of the participants, while Mukono district produced nearly half of the participants and MoES officials comprised only 0.7% to complete the total sample selected. Table 4.1 also shows that most of the participants (74.0%) were students. This means that students who were the primary target group of the study formed the largest proportion of the sample.

After establishing the categories of participants by districts, their distribution by gender was established as shown in Table 4.2 below.

Table 4.2 indicates that out of a total of 292 study participants, equal numbers of female (50%) and male (50%) participants were selected for this study. Out of the entire sample, more female student participants (38.4%) than males

(35.6%) were involved in the study and similarly more mothers (7.9%) than fathers (5.8%) were involved. More mothers than fathers were conveniently selected because they were the ones who were mostly available during the school visitation days. In the case of career and science teachers, head teachers and inspectors of schools, more males than females were selected according to their availability. Also, in the schools and districts, most science teachers and managerial posts were mainly held by males.

**Table 4.2 Distribution of the categories of participants by gender**

Category	Gender				Grand Total	
	Female		Male			
	f	%	f	%	f	%
Students	112	38.4	104	35.6	216	74.0
Parents	23	7.9	17	5.8	40	13.7
Science Teachers	5	1.7	9	3.1	14	4.8
Careers Teachers	2	0.7	4	1.4	06	2.1
Head Teachers	2	0.7	4	1.4	06	2.1
Directors of Studies	1	0.3	5	1.7	06	2.0
Inspectors of Schools	0	0.0	2	0.7	02	0.7
MoES Officials	1	0.3	1	0.3	02	0.6
<b>Total</b>	<b>146</b>	<b>50.0</b>	<b>146</b>	<b>50.0</b>	<b>292</b>	<b>100.0</b>

*Source: primary questionnaire data (2011)*

Socio-economic status of families has been found to be a factor that influences student's participation in education in different parts of the world. In a study done in Eastern Uganda, Onzima (2011) found a positive correlation between

the parents' level of income with pupil's educational performance. Onzima's results are confirmed by earlier findings of similar studies done in Uganda by Kakuru (2006), Kasente (2003), Nanyonjo (2007), Okumu, Nakajjo and Isoke (2008), and Alisa and Greg (2010). Based on this premise, the parents' socio-economic status was anticipated to influence the extent to which the GSBUSP would motivate students' participation in the sciences at A-level. In this study, the parents' socio-economic status were categorised into three classes. These included peasants who represented the low socio-economic class (LSEC), government employees such as doctors, lawyers and teachers who represented the middle socio-economic class (MSEC), and business men/women who represented the high socio-economic class (HSEC) as shown in Table 4.3.

**Table 4.3 Parents' socio-economic status**

Parent	Sex	Peasants (LSEC)		Government employee (MSEC)		Business man/woman (HSEC)		Do not know		Total	
		f	%	f	%	f	%	f	%	f	%
<b>Father</b>	<b>Boys</b>	5	5.7	56	71.7	14	16.9	5	5.7	80	100
	<b>Girls</b>	12	15.2	56	69.5	8	10.9	4	4.4	80	100
<b>Mother</b>	<b>Boys</b>	11	14.0	47	58.0	14	18.0	8	10.0	80	100
	<b>Girls</b>	9	11.5	49	61.5	14	17.3	8	9.7	80	100

*Source: Primary questionnaire data (2011), n=160*

Key:

**LSEC** Low Socio - Economic Class

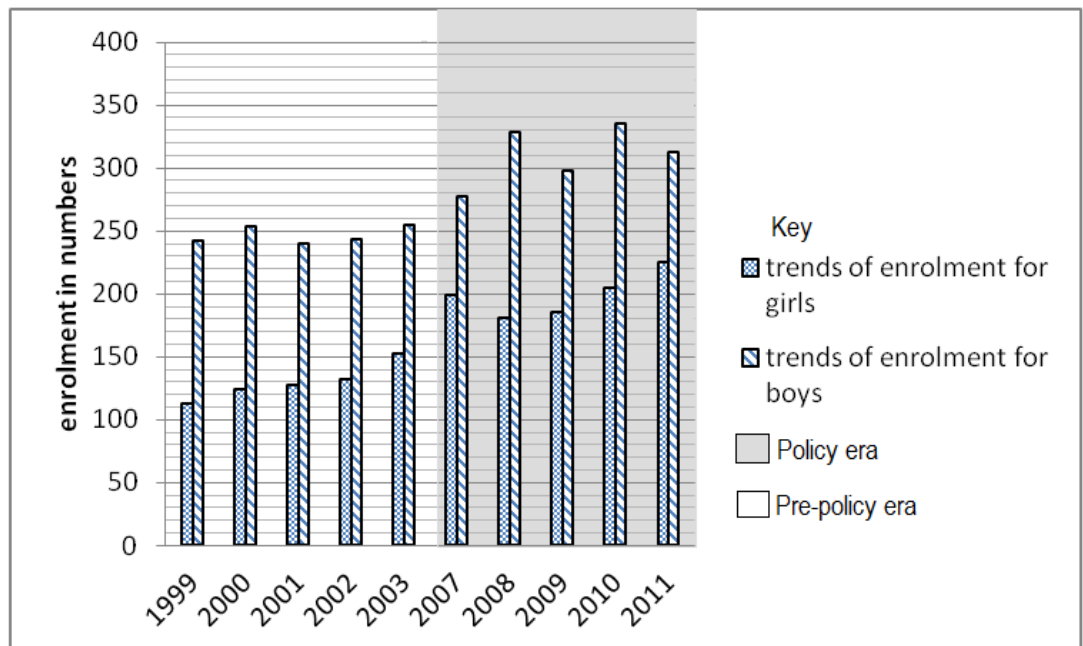
**MSEC** High Socio - Economic Class

**HSEC** High Socio - Economic Class

Table 4.3 indicates that on average, approximately two-thirds (61.5%) of the girls' mothers and fathers (69.5%) belong to the middle socio-economic class (MSEC) while slightly more than two-thirds of the boys' fathers (71.7%) and over half of the mothers (58.0%) belong to the same class. Table 4.3 also shows that fewer students had mothers and fathers from the low socio-economic class (LSEC) compared to the girls and boys whose parents came from the high socio-economic class (HSEC). It can, therefore, be assumed that majority of the girls and boys in this study had parents who could afford to pay university fees, without necessarily relying on government sponsorship, whose impact is the subject of this study.

#### **4.3 Comparison of Girls' and Boys' Enrolment in the Sciences at A-Level Before and After the Introduction of the GSBUS Policy**

The first objective of this study aimed at establishing the difference in enrolments between girls and boys in the sciences at A-level before and after the introduction of the GSBUSP. This was done in order to establish whether girls' enrolment in the sciences proportionately increased compared to that of the boys after the inception of the GSBUSP. The trend in girls' and boys' enrolments in the sciences at A-level before and after the policy inception was established as shown in Figure 4.1.



Source: Data compiled from records obtained from individual schools (2011)

**Figure 4.1 The Trend of students' enrolments in sciences at A-level before and after the GSBUSP inception**

The students' enrolment trends in Figure 4.1 indicate that the girls' and boys' enrolment in the sciences at A-level kept on increasing both before and after the inception of the Uganda GSBUSP. However, girls' enrolment remained lower than that of boys in the two eras. The lowest number of girls who enrolled for sciences in the pre-policy era was 113 (44%) in 1999 while that of the boys was 242 (62%) in the same year as shown in figure 4.1 and appendix X. The highest number of girls who enrolled in science subjects in the same period was 153 (56%) in 2003 while that of the boys was 255 (61%) in the same year. The trend of the students' enrolment percentages between 1999 and 2003 show that the proportion of girls' enrolment increased by 12% in 2003 while that of the boys decreased by 1% in the same year. These differences

show that in the era before the policy inception, the increase in girls' enrolment rate was higher than that of the boys.

Three years after the inception of the policy in 2007, the number of girls who enrolled for the sciences was 1999 (60%) while that of the boys was 277 (68%). In 2011, seven years after the policy's inception, girl's enrolment was 225 (52%), while that of boys was 312 (61%). The trends in the students' enrolment proportions show a decrease in the enrolment rate for the two genders. However the rate at which girls' enrolment in the sciences decreased was more than that of the boys.

A comparison of the students' enrolment trends in the two policy eras reveals that in the era after the inception of the policy, girls' experienced a 7% decrease in their enrolment rates, from 68% in 2007 to 61% in 2011. This is a declining enrolment compared to the 12% increase that they experienced in the pre-policy era, from 44% in 1999 to 56% in 2003. The possible reasons for the decline in the proportion of girls who enrolled in the sciences in the era after the inception of the policy are explained in section 4.4.

#### **4.4. Perceptions on why the enrolment rate for girls in the sciences declined**

Two reasons were advanced by career teachers and head-teachers for the decline in girls' enrolment in the sciences in the years after the inception of the GSBUSP. First was the introduction of Senior Five promotional examinations in the sciences. At the onset of the policy, schools adopted a relaxed policy of recruiting science students into Senior Five. The relaxed recruitment criterion

was adopted by the schools so as to have more of their students benefiting from the GSBUSP. Interviews with career teachers and head-teachers revealed that after the inception of the GSBUSP, schools were excited about the numbers of students showing interest in enrolling for the sciences and recruited more students into the science classes, including those with low grades. They explained that in the earlier years after the inception of the GSBUSP in 2004, even students with poor grades in Senior Five final examinations were promoted to Senior Six. Students with weak O-level grades usually failed final national Senior Six examinations, making them ineligible for the GSBUSP Sponsorship. The prevalent failure at the final Senior Six examinations, especially by students with low O-level grades in the sciences, made schools develop more stringent recruitment measures for registering students who would finally study the sciences in A-level. By 2007, most schools had tightened enrolment conditions into the Senior Six classes. Commenting on this new admission policy, one Director of Studies said:

...the rule of students with low passes repeating a class for the sake of improving their grades before being admitted into the candidate class was also introduced. Those who are not willing to repeat leave the school ... (IDI: Male DoS: Aguzu Mixed S.S.S;15/10/2011)

Second, schools are using higher grades as a pre-requisite for admitting students into the sciences at A-level. Careers teachers and Head-teachers were of the view that the prevalent failure of the final Senior Six examinations, especially by students with low O-level grades in the sciences, made most schools start using higher grades as a pre-requisite for admitting students into

the sciences at A-level. Commenting on this new admission policy, one Director of Studies said:

... Secondary schools, both girls and co-educational schools largely recruit only students who have excelled in the sciences at O-level 'with distinctions and at worst with credit three', regardless of their gender ... (IDI: Male DoS: Aguzu Mixed S.S.S;15/10/2011).

Commenting on the schools' use of higher grades as a pre-requisite for admitting students into the sciences at A-level, a parent gave the following recount of his daughter's experience;

...My daughter who had scored a credit four in Physics with distinctions in Biology and Chemistry was denied to study a science combination in one of the well performing A-level girls' secondary schools simply because she did not have a distinction in Physics. When I tried to plead with the school administration to consider my daughter's interest in sciences., I was told 'the fact that your daughter does not have a distinction in one of the science subjects in the combination she wants to study at A-level means that she cannot compete favourably for government university sponsorship'. There are many parents in the same situation like me... (IDI: A male Parent: 23/05/2012, Akwali Girls' S.S.S)

It should be noted that the above stringent recruitment conditions and performance rules could have led to the observed decrease in the proportions of girls' enrolment in the sciences at A-level in the years following the policy inception since some of them could not fulfil all the enrolment conditions.

#### ***4.4.1 The mean enrolment by gender and academic disciplines for the two policy eras***

To put the students' enrolment trends into perspective, their enrolment figures were converted into averages to show differences between girls' and boys'

enrolment in the sciences and Arts for the periods before and after the introduction of the policy as summarised in Table 4.4.

**Table 4.4 Students' enrolment in the sciences and arts before and after the inception of the policy**

		<b>Girls</b>			<b>Boys</b>		
		<b>Sciences</b>	<b>Arts</b>	<b>Total</b>	<b>Sciences</b>	<b>Arts</b>	<b>Total</b>
Before Policy	Enrollment	650	692	1342	1234	769	2003
	Mean Enrollment	130	138.4	268.4	246.8	153.8	400.6
	Percentage	48	51.6	100	61.6	34.4	100
After Policy	Enrollment	995	801	1796	1550	885	2335
	Mean Enrollment	199.0	160.2	359.2	310.0	177.0	487.0
	Percentage	55.4	44.6	100	63.6	36.4	100

*Source: Data compiled from records obtained from individual schools (2011)*

The results in Table 4.4 show that the average proportion of girls who enrolled for the sciences at A-level (Senior Six) was smaller (48.4%) than that of those who enrolled in Arts (51.6%) before the policy was introduced, representing a 3.2% difference in favour of those who enrolled in the Arts. However, in the period after the introduction of the policy the average proportion of girls who enrolled for the sciences was bigger (55.4%) than that for the Arts (44.6%), representing a 10.8% difference in favour for the sciences with an increase of 7%. In the case of boys, a bigger average proportion enrolled for the sciences (61.6%) compared to those who enrolled in Arts (38.4%) in the period before the inception of the policy, representing a 25.2% difference in favour of the sciences. Similarly, in the period after the introduction of the policy, a bigger average proportion (63.6%) of boys enrolled in the sciences than in Arts

(36.4%). This is represented by an enrolment difference of 27.2% in favour of the sciences. These results indicate that more boys enrolled for the sciences than girls both before and after the inception of the policy. These results indicate that the policy motivated more boys to enrol for the sciences than girls.

The 7% increase of girls' enrolment in the sciences after the inception of the policy was equally supported by career teachers in their interview sessions. In explaining this view, one careers teacher from Akwali Girls S.S.S noted "... since the inception of the policy, most O-level girls have been opting to study sciences at A-level ... they sacrifice an arts vacancy in a first world school to do sciences in a third world school..." Science teacher interviewees shared the same view and all of them made specific reference to how girls' enrolments in the sciences at A-level have increased over the years. In illustrating this view, one of the female teachers said:

... I have been teaching Biology at A-level in this school for over fifteen years, the Biology classes used to be about 14 and 15 students and it is the Artists who used to have the 40s and the 50s. In the policy era things changed, the Artists are the ones who have the 10s, 15s, now we have 49, 50 and 60 students per subject in the sciences. Biology now has 49, so 14 to 49 is a big leap especially for the girls...(IDI: Female ScTr: Akwar Girls S.S.S; 30/9/2013)

Results in Table 4.4 show that fewer girls 130 (48.4%) enrolled in the sciences in the years before the inception of the policy than in the period after the policy launch (199 (55.4%)). In reality, the difference between the proportions of girls who enrolled in the sciences before and after the inception of the policy was 7%. Statistically, the difference was established by subjecting their mean enrolment numbers to a *t-test* using the following null hypothesis:

*Ho1 There is no significant difference between girls' enrolment for the sciences at A-level before and after the inception of the GSBUSP at .05 level of significance.*

The result of a *paired samples t-test* obtained was  $t = 12.577$ ;  $p = 0.01$  (as shown in Appendix XIII). This  $p$  value implies that there is a significant mean difference in the enrolment of girls before and after the introduction of the policy in favour of the girls who enrolled after the inception of the policy. By rule of thumb, the hypothesis is rejected if the  $p$  value is less than 0.05, which is the level of significance. Thus, the null hypothesis is rejected and the conclusion is that the new policy may have led to the increase in enrolment of girls in the sciences at A-level, thus supporting interview data from the careers and science teachers.

The difference between the proportions of boys who enrolled in the sciences before and after the inception of the policy was only 2%, from 61.6% to 63.6%. The level of significance in the difference between the proportions of boys who enrolled in the sciences before and after the inception of the GSBUSP was statistically established by subjecting their mean annual enrolments to a *t-test* using the following hypothesis.

*Ho2 There is no significant difference between boys' enrolment for the sciences at A-level before and after the inception of the GSBUSP at .05 level of significance.*

The result of a *paired samples t-test* obtained was  $t = 6.649$ ;  $p = 0.01$ . This  $p$  value implies that there is a significant mean difference in the enrolment of

boys before and after the introduction of the policy. The p value in this result is less than 0.05, which is the level of significance. Thus, the null hypothesis is rejected and the conclusion is that the new policy may have led to the increase in enrolment of boys in the sciences at A-level.

The results in Table 4.4 also show that a lower proportion of girls (48.4%) enrolled in the sciences at A-level than that of boys (61.6%) before the inception of the policy, represented by a 13.2% difference in favour of the boys. There was a need to establish the statistical difference between the proportions of boys and girls who enrolled in the sciences before the inception of the policy by subjecting their mean enrolment numbers to a *t-test*. The difference between the mean enrolment numbers of girls (130.0) and boys (246.8) in the sciences before the inception of the GSBUSP was statistically tested using the following hypothesis.

*Ho3 There is no significant difference between the number of girls and boys who enrolled for the sciences at A-level before the inception of the GSBUSP at .05 level of significance.*

The result of a *paired sample t-test* obtained was ( $t = 21.346$ ;  $p = 0.01$  as shown in Appendix VIII). By this result, the hypothesis is rejected because the p value is less than 0.05, which is the level of significance. This result indicates that significantly more boys are enrolling in the sciences at A-level than girls in the period before the inception of the policy.

Table 4.4 reveals that in the period after the introduction of the policy, there were still fewer girls (55.4%) enrolling for the sciences compared to boys (63.6%), which represented 8.2% difference in favour of the boys.

The statistical difference between the proportions of boys and girls who enrolled in the sciences after the inception of the policy was established by subjecting their mean enrolment to a *t-test*. The difference between the mean number of girls (199.0) and boys (310.0) that enrolled in the sciences after the inception of the GSBUSP was statistically tested using the following hypothesis.

*Ho4 There is no significant difference between the number of girls and boys who enrolled for the sciences at A-level after the inception of the government science-based university sponsorship policy .05 level of significance.*

The result of a *paired sample t-test* obtained was ( $t = 8.608$ ;  $p = 0.01$  as shown in Appendix VIII). The  $p$  value in this result is less than 0.05, which is the level of significance. Thus the null hypothesis is rejected. This result indicates that significantly more boys are enrolling in the sciences at A-level than girls even in the period after the inception of the policy.

The conclusion, therefore, is that the introduction of the policy may be the one motivating more boys than girls to enrol for the sciences at A-level.

The results in Table 4.4 also show that the difference between girls' and boys' enrolment in the sciences before and after the introduction of the policy reduced by 5.2 %, from 13% to 8.2%. This decrease, however, did not

significantly bridge the difference that exists between the proportion of girls and boys who enrolled in the sciences in the era after the inception of the policy as indicated by the *t-test* result for hypothesis four. This result suggests that, in terms of enrolment, the girls remained significantly disfavoured even after the inception of the Uganda GSBUSP.

#### ***4.4.2 Some key factors related to girls' persistent lower enrolment in A-level Sciences***

During Focus Group Discussions (FGDs) with students and interviews with other interviewee participants, it became clear that there were persistent factors that were apparently linked to girls' under enrolment in the sciences at A-level as explained below.

The use of only the Uganda Certificate of Education (UCE) Science examination results for recruiting students into the sciences at A-level seemed to inhibit girls' participation in science-related courses at higher levels of education. Responses from parents and career teacher interviewees indicated that the selection criterion exclusively focuses on UCE national examination results for recruiting students who are eligible for the sciences at A-level, regardless of their gender and good performance in the school continuous assessment tests. This rigid selection criterion, which ignores the formative assessment performance of students, excludes girls who perform well in the sciences in school tests. A careers teacher interviewee explained:

...girls normally do not perform well in the final UCE science exams, especially in Physics and Chemistry; therefore they can't be offered sciences at A-level despite their averagely good

performance in the school tests...(IDI: A female CTr: Akwali Girls S.S.S, 5/10/2011)

The fact that the schools' selection criterion does not consider girls' formative tests scores in the recruitment of A-level science students cannot be ignored as a possible factor that lowers girls enrolment in the sciences at A-level. In the USA, scholarly evidence also established that the exclusive use of standardised entrance exams for recruiting girls into the sciences at higher levels of education inhibits their furtherance in science (Evans, 2002; Jones, Howe, & Rua, 2000). According to Evans (2002), when scores of standardised entrance exams are used for recruiting applicants into various advanced science programmes, girls who do not perform well in these exams and yet, they perform better and receive better science grades in school tests than boys. Arguably also, the exclusive use of the final performance at O-level for recruiting students into A-level science courses negates the value of continuous assessment tests in which the girls reportedly perform relatively well.

Interviews with career and Science teachers revealed the perception that getting low grades in the science among the girls tended to make the girls opt out of these course because they easily got discouraged, intimidated and hence, lost much of their self-confidence. In agreement with this view, one Science teacher said;

...it truthfully happens that at O-level final exams, girls generally perform better in Arts subjects than in Science subjects. They score 80s, 90s, and 70s in History, Commerce, Literature, CRE, Geography, yet 20s, 30s, 40s and 50s, in science subjects. This is enough to make girls think negatively towards Sciences and positively towards Arts... (IDI: A male Tr, 26/10/2011, Ngoi Mixed S.S.S)

The above excerpt suggests that the girls felt less obligated and, perhaps, less motivated to continue studying the sciences when faced with the challenge of poor performance in science subjects. This may mean that girls were falling into the trap of fulfilling the prophecy that femininity was inconsistent with science even though their continuous assessment tests prove otherwise. This observation is supported by Alexa's (2011) theory, which asserts that females attribute their achievements to effort and their failures in fields such as math and sciences to lack of ability and, thus, tend to show lower motivation in these fields. Seymour and Hewitt (1997) also found that poor performance in the sciences, coupled with the cultural belief that Science is a masculine arena, makes girls in the USA feel they have permission to quit studying the sciences. Alexa also asserts that unlike females, males have a higher level of motivation to study the sciences because they attribute their achievements to ability due to the belief that their talents in these areas are natural attributes. Consequently, even when they encounter the discouraging academic atmosphere such as scoring poor grades in sciences subjects, males feel obligated to stay because of their sense of duty to others (parents, counsellors and teachers), who expect them to pursue the sciences at all costs (Seymour and Hewitt, 1997).

Girls' low self-esteem was another factor that led to the enrolment gap between boys and girls. This view is supported by the following excerpts: A boy from Ngoi Mixed S.S.S in an FGD session observed that "*girls fear to enrol for Sciences because most of them have low self-esteem to do Sciences*" Further, a male Science teacher from Aguzu Mixed S.S.S was of the view that "... *girls*

*think they are weak in maths and science and so cannot waste time enrolling for it...*” and a father from Ogudu Boys’ S.S.S observed that “*Girls always take themselves to be having weak brains that can’t handle Sciences*”. According to a male District Inspector of Schools, “*... girls believe that Sciences are hard subjects that should be done by boys who are more intelligent...*”

Strikingly, girls and mothers also echoed the above male dominant discourse about female underperformance in the sciences. For example, a girl at Akwar Girls S.S.S observed that; “*... girls lack confidence in their ability to study Sciences...*” while another girl at Aguzu Mixed S.S.S stated; “*... girls shy away from Sciences because they feel less knowledgeable...*” A mother from Akwali Girls’ S.S.S also noted; “*... girls require a soft life not to be hardened by the tough Science subjects...*”

The perception that girls require a soft life and lack qualities required for successful achievement in the sciences points to the cultural upbringing that trains them to be soft and subordinate to men. However, the presence of distinguished female scientists as presented in section 2.1 of the literature review disproves the notions about girls and science mentioned in the excerpts above. Therefore, girls who opt out of the sciences due to the cultural masculinisation of the sciences as presented in the excerpts above do not want to behave contrary to what society expects of them. Society expects girls to be: ‘*weak*’ ‘*shy*’ ‘*less knowledgeable*’ ‘*less intelligent*’ and ‘*soft*’ as per the above excerpts. Adams (1996) also found that some girls in the USA rejected studying the sciences because they succumbed to perceiving the sciences as a

male domain, making them to be unwilling to exhibit the scientific behaviours. Adams further observed that girls who pursued science careers were labelled as obnoxious and bossy by the teachers and their peers because they were: active, curious, questioning and assertive. According to Smith (1992), though these behaviours promote success in quantitative fields, they are unfeminine. Thus, there is a conflict between traditional feminine stereotypes and the essence of science which, according to Smith, is a systematic effort to understand physical objects and their relationships in terms of an objective, and impersonal perspective.

All the four science teacher interviewees in the co-educational schools observed that the dominant presence of boys in the science classes with very few women science teachers as role models discouraged girls from choosing science options. This view was confirmed by the fact that of the 24 A-level science teachers found in the schools in the study, only five were females and of these, only one was found in the two co-educational schools involved in this study. All the four teacher respondents in the co-education schools further observed that when boys consistently enrol in high numbers in science subjects and girls are consistently fewer in the same subjects, girls in mixed schools tend to get discouraged and drop out of the sciences at A-level. This view was confirmed by a girl from Akawli Girls S.S.S when she said: “... *the dominance of boys in Sciences at higher levels of education discourages a girl because she does not want to be an only girl in a class of 20 boys...*” Scholarly evidence in the literature review also confirms that having small numbers of women in the

STM disciplines made some girls in Austria, Germany, France (Lynch & Feeley, 2009) and in the USA (DeBacker & Nelson, 2000) to perceive science education as a male domain.

This finding indicates that although a competent girl would wish to enrol for the sciences at A-level, being an only girl among many boys in a science class discourages her from choosing to study the sciences. This reluctance to participate in a male dominated field is partly explained by the fact that girls are still controlled by traditional stereotypical beliefs in patriarchal societies that categorically dictate norms of interaction between men and women. Such norms stipulate that women should not cross into male dominated fields because this will make them unfeminine and sexually unattractive in a heterosexual world (Lynch & Feeley, 2009). This “male domain-avoiding syndrome” by women makes it unlikely that girls’ enrolment in the sciences can move to equilibrium with that of the boys (Whittock, 2002).

In order to understand the persistent low enrolment of girls in the sciences, there is a need to acknowledge the role played by poor exposure of girls to the sciences in the schools at the inception of formal education in Uganda. In Uganda, when girls started attending school, there was a structural difference in the curriculum which was offered to boys and girls. During the colonial era in both co-educational and single girls’ schools in Uganda, the missionary teachers excluded science subjects from the girls’ curriculum. This was because the missionaries’ aim of educating girls was to “... *produce a girl accomplished, in all ways for the requirements of a housewife in Uganda*”

(Ssekamwa and Lugumba, 1973, p.41). Consequently, the girls' curriculum consisted of "*digging, plaiting mats, cooking and sweeping the floors*" (Ssekamwa and Lugumba, 1973, 173 p. 41). It is important to note that the objective of missionary education was in line with the heritage of the African patriarchal societies.

Tripp and Kwesiga (2002) affirm that in patriarchal societies the domestic roles of mother, wife and homemaker are the key constructions of women's identity. Therefore, the exclusion of the sciences from the girls' school curricula instilled into them a deep-seated gender belief that science is a male domain. Consequently, though science subjects were finally made compulsory for O-level students after Uganda got independence, they were not popular among girls, partly because of the deep-seated gender ideologies that were instilled in them right from the inception of formal education in Uganda. This observation is supported by Kalyati (1996) in Malawi and Tamale (2004) in Uganda, who found that the phenomenon of girls' enrolment being lower than that of the boys in the sciences was partly due to traditional cultural beliefs that peg the purpose of women's existence to marriage, childbearing, and caring for the family. In this regard, therefore, girls' low enrolment in the sciences in Uganda is due to the influence of deep seated gender ideologies, which started right from the introduction of formal education to-date.

Part of the girls' low enrolment in the sciences at A-level is also due to their higher attrition rate than that of boys as they move up in the education system. Participants pointed out that the girls' dropout rate at lower levels of education

is higher than that of the boys due to various factors such as: “...*lack of school fees, early pregnancy and marriage and parents’ unwillingness to send girls to school...*” Commonwealth Education Fund (2005) confirmed that in the primary schools in Uganda, a host of factors continue to keep girls’ dropout rates higher than those of the boys. Similarly, Kwesiga (2002) confirmed that in Uganda, girls have always been outnumbered by boys at the Ordinary level of Uganda’s Secondary School Education System due to various reasons. These findings suggest that the lower enrolment of girls than boys in the sciences at lower levels of education is perpetuated at the higher levels of education, A-level inclusive.

In summary, the findings for objective one reveal that enrolment for both girls and boys increased significantly after the inception of the GSBUSP. The increase among girls in the sciences after the inception of the policy portrayed a statistical significance of  $t = 12.577$ ;  $p = 0.01$  while that of the boys was  $t = 6.649$ ;  $p = 0.01$ . A comparison of the two genders’ mean enrolment proportion rates in the two eras of the policy revealed that the girls’ rate of enrolment increase was higher (48.4% vis-à-vis 55.4%) than that of the boys (61.6% vis-à-vis 63.6%) after the inception of the policy. However, the statistical results show that the increase in girls’ enrolment in the science after the inception of the policy was significantly not proportionate to that of the boys. The difference between the mean number of girls and boys enrolled in the sciences at A-level after the inception of the policy portrayed a statistical significance of  $t = 8.608$ ;  $p = 0.01$ . More girls (55.4%) enrolled in the sciences after the

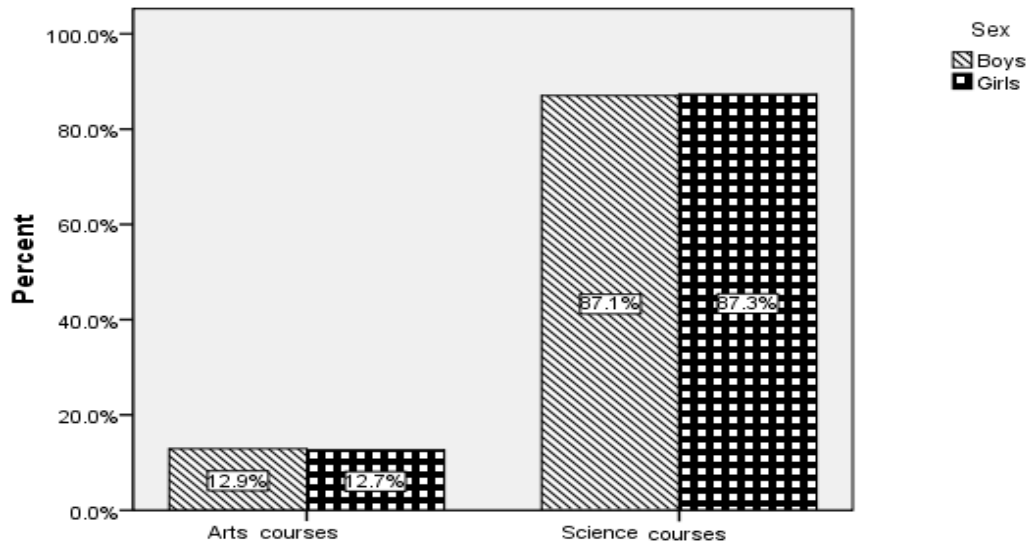
introduction of the policy than before (48.4%) its introduction. This raised a second key question whether to attribute the increased enrolment of girls in the sciences to their awareness of the benefits that the policy can offer. This is the subject for Objective Two in the next sub-section.

#### **4.5 Girls' and Boys' Awareness of the GSBUSP and their Choice for Sciences**

The second objective was to establish the relationship between girls' awareness of the GSBUSP and their choice to enrol in the sciences at A-level as compared to that of the boys. In order to establish this, it was important, first, to determine whether girls and boys were aware of the GSBUSP.

##### ***4.5.1 Girls' and boys' awareness of the GSBUSP***

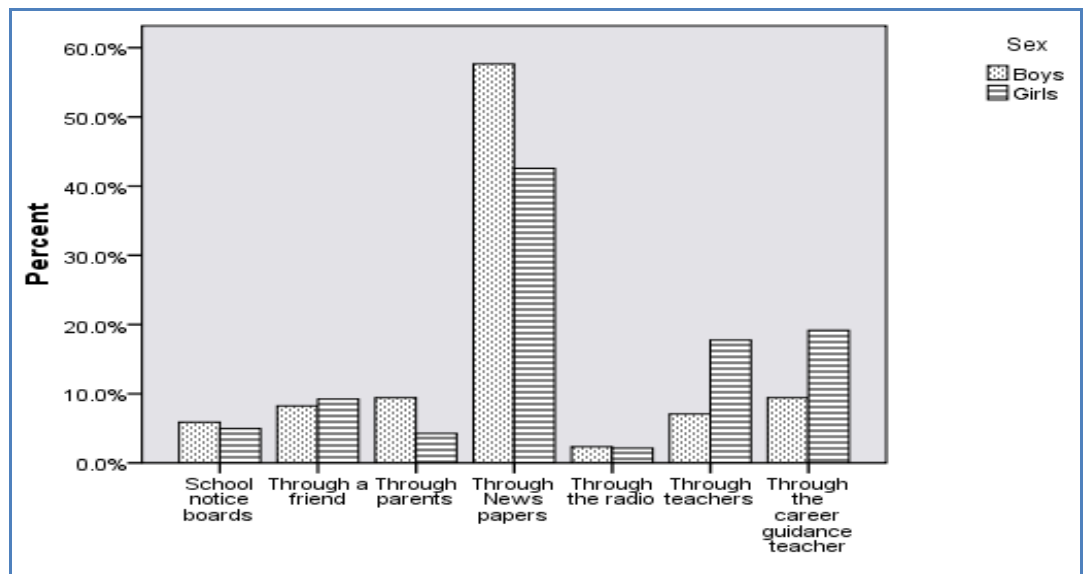
In the survey questionnaire, students were asked to indicate the courses that are mainly sponsored by the government in public universities. Over three quarters of the girls (87.3%) and boys (87.1%) indicated that they were aware that the government mainly sponsors science courses as compared to arts at the university (Figure 4.2).



Source: Field data (2011)

**Figure 4.2 Girls’ and boys’ awareness of the GSBUSP**

Figure 4.2 shows the majority of girls and boys indicated they were aware that the government mainly sponsors science-related courses in public universities through its Science-based sponsorship policy. These students obtained information about the GSBUSP from different sources as shown in Figure 4.3.



Source: Field data (2011)

**Figure 4.3 Sources of information about the GSBUSP**

Figure 4.3 presents newspapers as the leading source of information for most girls (45%) and boys (58%). Besides newspapers, more girls than boys obtained information from career teachers (22%) and science teachers (20%) as compared to only 12% and 8% of the boys. However, more boys (11%) obtained information from parents as compared to only 4% of the girls. School notice boards and radios were the least identified sources of information for both genders. These results reveal that students were generally aware of the policy, mainly, through non-school-based sources like the press.

It should be noted that giving such important information through the press instead of school-based channels is a disadvantage to students from low socio-economic backgrounds because they have limited access to the mass media. Consequently, only students from high socio-economic backgrounds were largely accessing this information. It was anticipated that the policy would increase the number of students studying the sciences at A-level by motivating them to enrol for the sciences as a means for obtaining the government university sponsorship (Athmani, 2009). For girls who were aware of the policy, it was important to establish if this awareness had any influence on their choice to enrol to study the sciences at A-level as compared to boys.

#### ***4.5.2 Influence of the Uganda GSBUSP on students' choice to enrol for the sciences***

Girls and boys were presented with a list of the monetary benefits of the GSBUSP, and were asked to specify those that influenced their choice to enrol

for the sciences. The results of the students' responses are summarised in Table 4.5.

**Table 4.5: Girls' and boys' indication of the reasons for choosing sciences at A-level**

Policy components	Girls				Boys			
	Yes		No		Yes		No	
	f	%	f	%	f	%	f	%
The GSBUSP	36	45.0	44	55.0	51	63.8	29	36.2
Tuition fees	34	42.5	46	57.5	48	60.0	32	40.0
Meals' fees	11	13.8	69	86.2	17	21.2	63	78.8
Accommodation fees	20	25.0	60	75.0	30	37.5	50	62.5
Faculty fees	26	32.5	54	67.5	40	50.0	40	50.0

*Source: Field data (2011)*

Table 4.5 shows that nearly half of the girls (42.5%) and most of the boys (60.0%) indicated waiving of tuition fees as the reason for studying the sciences at A-level. Table 4.5 also shows that the least number of students indicated provision of meals (13.8% girls and 21.2% boys) and accommodation (25% girls and 37.5% boys) as reasons that motivated them to choose to study the sciences at A-level. From the interviews, it emerged that girls and boys deemed meals and accommodation as the least valuable monetary benefit of the GSBUSP required for the achievement of university education. According to them, one cannot be registered as a university student before paying university tuition fees and faculty fees while meals and accommodation fees are optional. During the FGDs and interview sessions, students, parents, teachers and district education officials identified the role of the tuition fees

waiver benefit of the GSBUSP as a motivator for some of the girls' and boys' choice to enrol for sciences.

One of the boys from Okodi Boys' S.S.S explained saying; "... *among us are poor students who were advised by parents and guardians to do sciences because they offer the ticket for university tuition fees...*" Similarly, a male Careers Teacher from Aguzu Mixed S.S.S confirmed this view saying "... *I know of girls and boys from poor homes who have forced themselves to do sciences at A-level because they will never get university education without government sponsorship...*" In support of the above assertions, a mother from Akwali Girls S.S.S said, "... *because I am a very poor guardian without salary; my daughter knows that with science subjects she has a better chance of getting tuition fees for university education...*" Likewise, one male District Inspector of schools noted, "... *one of the reasons why some girls force themselves into sciences is to be able to qualify for government sponsorship...*"

In agreement with the Inspector's view, one girl recounted her friend's experience,

... I have a friend who is good at both Arts and sciences, however, she is studying the sciences solely because her guardian insisted that it is the only way she can compete for government sponsorship and get a university education, otherwise she loves Literature and Economics so much and wanted to study them at A-level..." (FGD: Aguzu Mixed S.S.S, 15/11/2011)

Talking about her experience, another girl explained:

... I had to do sciences because my parents are already so burdened with university fees that they can't afford paying for another child. I already have two sisters on private sponsorship

at the university and my parents can't afford additional university fees for me... (FGD: Ngoi Mixed S.S.S; 26/10/2011)

These excerpts reveal that the economically disadvantaged girls and boys enrolled in the sciences at A-level as a means to access the benefit of the waiver of university tuition fees entailed in the GSBUSP package. This finding suggests that in this study, students from low socioeconomic backgrounds base their decision to study the sciences at A-level on the utility value consideration stipulated in Eccles' Subject-Task Value Theory (CF section 1.11). In the utility value consideration, Eccles (2005) pre-supposes that the girls' choice of a task, science subjects in this context, is in reference to how important the task is for attaining some other short or long term goal, which in this case is the government university sponsorship.

The waiver of university tuition fees entailed in the GSBUSP package is relevant for students from poor families because such students find university education too expensive to afford. In this context, poverty is a factor that enhances the policy's ability to motivate students' choice to enrol for the sciences. The waiver of university tuition fees contained in the GSBUSP package may help reduce the risk of having children from low socio-economic status backgrounds drop out of school after their A-level examinations. Aikens and Barbarin (2008) and, Ready (2010) confirm that in the USA and Africa, children from low socio-economic status households and communities fail to attend school due to inability to pay school fees by parents and guardians. This is attested to by the fact that in Uganda, all the beneficiaries of the Female Scholarship Initiative (FSI) in Makerere University (Aramanzan & Mutuwa,

2005) and the Mvule FAWEU Trust Scholarship belong to the “poorest world’s population that live on less than a dollar a day” (Mvule Trust, 2007).

It is worth noting that in this study, girls from the low socio-economic status homes often suffer the consequences of scarce resources on students’ access to education more than the boys. One District Inspector said; *“in the face of poverty, parents may force the girls to take arts which require less costs compared to sciences according to the fees’ structure of some schools”*. A parent, on one hand, observed that poverty makes some families to *“pay boys fees first while the girls wait...in the long run the girl will desire to get married other than stay at home”*. One head-teacher, on the other hand, said *“... some parents do not pay for girls at A-level but want them to finish short courses and get married as the bride price may be lost when the girl grows old studying...”* Studies in some of the poorest countries in South Asia and in the world over also reveal that due to scarce resources, 12 per cent more boys than girls enrolled in primary school (Commonwealth of Learning, 2013).

Table 4.5 further indicates that slightly less than half of the girls (45.0%) indicated that they chose to enrol for the sciences at A-level in order to access the monetary benefits entailed within the Uganda GSBUSP at university level, compared to nearly two-thirds of the boys (63.8%), who chose to enrol for the sciences for the same reason. These results suggest that more boys than girls were motivated to enrol for the sciences at A-level by the benefits entailed in the Uganda GSBUSP, such as the faculty allowance and the various fees’ waivers in relation to accommodation, meals, and tuition fees. This finding

suggests that more boys than girls enrolled for the sciences at A-level for a utility value consideration. Hewitt and Seymour's (1997) also found that more boys than girls in the USA enrolled in the sciences for utility value-based reasons. Eccles' (2005) Subject-Task Value Theory defines the utility value as the influence of how useful and important the task is for attaining some other short or long term goal on a person's decision to do a task (Section 1.11 in Chapter one).

Table 4.5 also shows that more girls (55%) than boys (36.2%) indicated that they were not motivated to enrol for the sciences at A-level by Uganda GSBUSP. In addition, Table 4.5 reveals that more girls than boys indicated that they were not motivated to enrol for the sciences at A-level by the specific monetary provisions contained in the Uganda GSBUSP. These findings suggest that these girls and boys were motivated to enrol for the sciences at A-level by other non-fees-waiver related reasons. These other non-fees-waiver reasons are presented in the next sub-section.

#### ***4.5.3 A comparison of boys' and girls' non-fees' waiver reasons for choice of the sciences***

In the study, the researcher further endeavoured to establish other reasons that motivated girls' and boys' choice to enrol for the sciences at A-level besides the faculty allowance and fees waivers benefits entailed in the Uganda GSBUSP package. Responses obtained from the survey questionnaire showed that over three quarters of the boys indicated that they were encouraged to enrol in the sciences by non-fee waiver reasons such as academic ability

(98.8%) and the employment science careers guarantee (87.5%). On the contrary, only approximately two-thirds of the girls (64.1% and 60.5%, respectively) indicated the same reasons (Appendix XII). These findings reveal that more boys than girls indicated academic ability to do the sciences well, and availability of science-related jobs as the non-fee waiver considerations that influence their choice of the science subjects at A-level.

The above findings confirm the suppositions in Eccles' (2005) Subject-Task-Value Theory that attainment and utility values do influence students' decisions to do tasks. In the context of this study, the influence of ability to do the sciences well on students' decision to enrol for the sciences is a confirmation of the attainment value consideration stipulated in Eccles' (2005) Subject-Task-Value Theory. In this Theory, the attainment value refers to choice of a task being influenced by the importance derived from having the ability to do well on a task as the basis for choice. The influence of the availability of science-related jobs on the students' decision to enrol for the sciences is a confirmation of the utility value consideration stipulated in Eccles' (2005) Theory. In Eccles' Subject-Task-Value Theory, the utility value refers to choice of a task being influenced by how important the task is for attaining some other short or long term goal. In this study therefore, students who have chosen to do the sciences at A-level as a means for attaining the available science-related jobs in the labour market are basing their choice of the sciences on the utility value. However, fewer girls than boys indicated that

they were motivated to enrol for the sciences at A-level by ability and employment-related reasons as illustrated by the above statistics.

Parent interviewees also indicated that the boys' choice of the sciences at A-level was influenced by the ability to do the sciences well and the available job market for science professionals. Commenting on his son's experience, one father from Ogudu Boys' S.S.S said: *"...government sponsorship is a by-the way, the strong drive for my son's choice to do sciences at A-level is his ability in sciences..."* Another father from Okodi Boys' S.S.S made the following remark about his son *"...John's competence and awareness of the available well-paying science related jobs made him decide to study sciences at A-level..."* A mother from Ngoi Mixed S.S.S supported the above views when she made the following comment about her son, *"... his good performance in sciences and the available jobs for professional scientists made him to take sciences..."*

The above excerpts reveal that boys were motivated to choose to enrol for the sciences at A-level because they were more assured about their abilities in the sciences and employment in the available science-related jobs. The data show that fewer girls than boys were motivated by the same reasons. These results are supported by Etzkwitz, Kemelgor and Uzzi (2000), who also found that boys and men in European countries opted for science related careers because they were more confident about their abilities in science than girls and women.

It should be noted that good grades in the sciences are a requirement for accessing government's university sponsorship. It is stipulated in the Uganda

GSBUSP that the 53% beneficiaries of the government science-based university sponsorship slots will be selected on academic merit (Akankwasa: MoES official communication, March 7<sup>th</sup>, 2005). The ability to score high grades in the sciences is also one of the non-monetary policy benefits that was indicated by most boys (98.8%) as the reason for choosing to study the sciences at A-level. Consequently, it is safe to argue that, more boys than girls (64.4%) are motivated to study the sciences at A-level by a non-fee waiver component that is contained within the policy. In this context therefore, the policy favours boys more than girls.

Responses obtained from the survey questionnaire showed that over three quarters of the girls indicated that they were encouraged to enrol for the sciences by non-fees waiver reasons such as personal interest (97.5%) and identity (92.2%), while only slightly more than half of the boys (68.8% and 62.5%, respectively) indicated the same reasons (Appendix XII). This finding was confirmed by responses from the girls' FGDs and parents' interviews.

Female students in different FGD sessions indicated that the nature of the science subjects made them choose to study the sciences at A-level. Three girls expressed this view in the following comments: “...*I love sciences because they do not involve cramming*”, “...*I like sciences because they make me to discover the unknown...*”, and “...*I like sciences because they are predictable and logical...*”

In order to emphasise how the love for the sciences influenced her to enrol for the sciences other than the fee waiver benefits of the GSBUSP, one female student argued:

... I would have done sciences with or without the sponsorship, because I like them naturally..... I would never do sciences just for the sake of becoming a beneficiary of government's sponsorship at the university, when I have no passion for science subjects... (FGD: A girl: Akwali Girls S.S.S; 5/10/2012)

Two female students emphasised that even having the ability to perform well in science subjects and the available science jobs minus interest in the sciences would not motivate them to enrol for the sciences. One girl said:

... If you have no interest, you will find the science combination very difficult to handle and chances of failing are high. That is why there are fake science professionals who put away the science certificate after studying and end up doing what they really love doing like music, or whatever,... So it is better to do sciences out of interest above all, and that is why I am doing a science combination...(FGD: A girl: Ngoi Mixed S.S.S;26/10/2011)

Another girl added:

... in this school, there are girls who passed sciences with excellent grades at O-level but did not enrol for them at A-level because they have no interest in sciences..." (FGD: A girl: Akawli girls' S.S.S; 5/10/2011)

The above two excerpts imply that, the role of interest in motivating girls to enrol for the sciences at A-level superseded the ability to perform well in the sciences, which is the main motivating factor for the boys as revealed above.

One mother identified love for the creativity offered by the sciences as a reason for her daughter to enrol for the sciences when she said:

... Government sponsorship is insignificant, because without the love for the creative nature of sciences my daughter would not have an interest in the science combination and would not study sciences only for the sake of government sponsorship... (IDI: A mother: Ngoi Mixed S.S.S, 15/12/2011)

The girl's and the mother's responses above reveal that it is interest in science-related courses and careers that motivate many girls' choice to enrol for the sciences at A-level rather than the desire for government sponsorship. In relation to Eccles' (2005) Subject-Task Value Theory, this means that the girls' choice to enrol for the sciences at A-level is motivated by intrinsic value considerations associated with their love for the sciences rather than the utility value consideration of becoming beneficiaries of the government' science-based university sponsorship policy, and the science jobs available in the labour market. It is on this basis that governments and NGOs in many developed countries invest more in advocacy campaigns aimed at stimulating, sustaining and increasing girls' interest in the sciences (MacDonald, 2002; (Society of Women Engineers, 2004).

Responses obtained from the survey questionnaire showed that more girls (92.2%) than boys (62.5%) indicated that they were motivated to enrol for the sciences by a successful female/male scientist they admire. Similarly, five parents, (2 mothers and 3 fathers) who were interviewed noted that their daughters enrolled for the sciences mainly because they wanted to be scientists like their relatives in the field of science. Three of the five parents recounted the experiences of their daughters as follows: A mother from Aguzu Mixed SSS said; "... *my cousin who is her aunt is a doctor so she really wants to be a*

*doctor like her...*” and a father from Ngoi S.S.S said the following of his daughter; “... *she has a brother who is an engineer hence the love for science subjects ....*” A mother from Akwali Girls S.S.S acknowledged her influence on her daughter’s choice to enrol for sciences when she explained “... *I tried to encourage her to take sciences probably because I am also a scientist...*”

During the FGDs, girls also indicated the influence of ‘significant others’ in the family as one of the main motivators for their choice to enrol for the sciences at A-level. In this respect, three girls said: “... *my mum is a scientist, a medical doctor and I want to be like her...* (A girl: Akwali Girls S.S.S), *my dream is to become a doctor... I had my sister who did sciences and became a doctor, so I admired her...* (A girl: Aguzu Mixed SSS), “... *I was influenced by my sister who is a nurse...*” (A girl: Ngoi Mixed SSS).

The above interview excerpts reveal that some girls were motivated to study the sciences at A-level by successful scientists who were their relatives. Scientists outside the family circles were not particularly cited by participants in the current study as role models that motivated girls’ choice to enrol for the sciences. On the contrary, girls in Malawi (Gomile-Chidyaonga, 2003), the USA (MacDonald 2002; SWE, 2004) and Ghana (Quaisie, 1996), were mainly motivated to enrol for the sciences by female scientist in the community who were not relatives. This is probably because girls in the current study hardly participated in science camps/clinics, which provide girls with opportunities to interact with female scientists in the community such as their counterparts in the countries mentioned above. In spite of this difference, the finding in the

current study underscores the point that close interaction with family members who are “successful scientists” in the eyes of the girls motivated them to choose to enrol for the sciences.

It should be noted that personal interest in the sciences and the influence of role models are not stipulated in the Uganda GSBUSP as requirements for one to be legible for the sponsorship. Yet, the ability to do well in the sciences is stipulated as a requirement for one to qualify for the Uganda GSBSUSP. This means that more girls than boys were motivated to choose to enrol for the sciences at A-level by non-fees waiver reasons external to the policy. In this context, the policy provisions do not favour girls as compared to boys.

#### ***4.5.4 Linking students’ awareness of the policy to their choice of the sciences***

A correlation analysis was used to establish whether girls’ and boys’ awareness of the GSBUSP had any significant relationship to their choice to enrol for the sciences at A-level. This analysis involved correlating scores on students’ awareness of the GSBUSP and scores on their responses to the questions that sought to establish whether their choice to enrol for the sciences at A-level was based on the desire to benefit from the various monetary components of the GSBUSP. It is on this basis that the following hypothesis was tested.

*Ho5 There is no significant relationship between girls’ awareness of the government’s science-based university sponsorship policy and their choice of the sciences at A-level at .05 level of significance.*

A Pearson Product Moment Correlation Coefficient ( $r$ ) was used to establish the relationship between girls' awareness of the policy and their choice to enrol for the sciences at A-level. The results are summarised in Table 4.6.

**Table 4.6: Relationship between girls' awareness of the policy and their choice to enroll for the sciences at A-level**

		Correlations	
		girls' awareness	girls' choice to enrol for sciences
girls' awareness	Pearson Correlation	1	-.032
	Sig. (2-tailed)		.781
	N	80	80
girls' choice to enrol for sciences	Pearson Correlation	-.032	1
	Sig. (2-tailed)	.781	
	N	80	80

Table 4.6 shows a weak negative but not significant correlation ( $r = -0.03$ ;  $p = 0.781$ ) between girls' awareness of the policy and their choice to enrol for the sciences at A-level. Since the  $p$  value observed here is greater than 0.05 level of significance, this implies that the hypothesis which stated that there is no significant relationship between girls' awareness of the government science-based university sponsorship policy and their choice of the sciences at A-level is retained. The negative correlation also implies that the more girls were aware of the policy, the more it did not influence their choice of the sciences at A-level. These results are similar to those in Table 4.5 where more than half of the girls (55%) indicated that becoming a beneficiary of the government sponsorship scheme at the university level was not the reason for their choice to enrol for the sciences at A-level.

A weak and not statistically significant correlation implies that any relationship between girls' awareness of the policy and their choice to enrol for the sciences at A-level was negligible. These results, therefore, indicate that awareness of the policy does not have a significant utility value influence on girls' choice to enrol for the sciences at A-level. The utility value in this context refers to the basis for choosing a task based on its importance in attaining some other short or long term goal (Eccles, 2005). Evidently, the girls' decision to choose to study the sciences at A-level is a result of other factors, and not the desire to become beneficiaries of the fees waiver benefits entailed within the Uganda GSBUSP. Similarly Kay, Steve and Keith, (1994) in the USA found no relationship between the Oklahoma Future Teacher Scholarship and the female student teachers' choice to enrol for science education at the university level.

As for the boys, the following hypothesis was used to establish the relationship between their awareness of the policy, and choice to enrol for the sciences at A-level.

*Ho6 There is no significant relationship between boys' awareness of the government's science-based university sponsorship policy and their choice of the sciences at A-level at .05 level of significance.*

A Pearson Product Moment Correlation Coefficient (r) was used to establish the relationship between boys' awareness of the policy and their choice to enrol for the sciences at A-level. The results are summarised in Table 4.7.

**Table 4.7: Relationship between boys' awareness of the policy and their choice to enroll for sciences at A-level**

		Correlations	
		boys' awareness	boys' choice to enrol for sciences
boys' awareness	Pearson Correlation	1	-.224*
	Sig. (2-tailed)		.046
	N	80	80
boys' choice to enrol for sciences	Pearson Correlation	-.224*	1
	Sig. (2-tailed)	.046	
	N	80	80

\*. Correlation is significant at the 0.05 level (2-tailed).

Table 4.7 shows a weak negative but statistically significant correlation ( $r = -0.224$ ;  $p = 0.046$ ) between boys' awareness of the policy and their choice to enrol for the sciences at A-level. Since the  $p$  value observed here is less than 0.05 level of significance, it implies that the hypothesis that there is no significant relationship between boys' awareness of the government's science-based university sponsorship policy and their choice of the sciences at A-level is rejected. The conclusion is that there is a significant relationship between boys' awareness of the policy and their choice to enrol for the sciences at A-level.

The negative sign in the correlation implies that the more boys were aware of the policy, the less likely they were to choose the sciences for the sake of sponsorship. However, this correlation was weak to the extent that only few boys (36.2%) indicated that they were not motivated to enrol for the sciences at

A-level for sake of the policy benefits. A weak but significant correlation implies that, whereas the correlation is small, it strengthens the boys' desire to enrol for the sciences at A-level for the sake of the policy benefits. This finding is supported by results in Table 4.5, in which more than half of the boys (63.8%) indicated that their choice of the sciences at A-level was motivated by the desire to benefit from the GSBUSP.

The above observation was confirmed by establishing the correlation coefficient of determination ( $r^2$ ), which showed that a proportion of only 5% ( $r^2 = 0.05$ ) of the boys' motivation to enrol for the sciences at A-level was related to their desire to benefit from the monetary components of the GSBUSP. The other 95% of the boys' decision to enrol for the sciences at A-level is influenced by other factors rather than the GSBUSP. In this context therefore, the influence of the policy on the boys' choice to enrol for the sciences from Eccles' (2005) a utility value consideration is weak compared to other factors. These results, therefore, reveal that awareness of the policy is not a major influencing factor in boys' choice to enrol for the sciences at A-level. Comparing the influence of the policy on girls' and boys' decision to enrol for the sciences at A-level, the results show that boys are less but significantly influenced by the policy (with  $r = -0.224$  and  $p = 0.046$ ), while the girls are not. Therefore, the policy is in favour of the boys and not girls.

As noted earlier, it could be assumed that students' awareness of the policy would increase choice to enrol for the sciences at A-level. However, this still needs further investigation to arrive at an accurate conclusion. For example, it

could be possible that students that had better access to information about the policy were also those that were unlikely to be influenced by the policy. Students who come from relatively wealthy families were likely to be inspired to study the sciences by factors other than the hope of having their education costs covered by government sponsorship, because their parents are less constrained by the burden of school costs. Therefore, though such students have access to information from sources such as newspapers, television, parents who work in offices dealing with policy matters such as civil servants, more exposed peers, among others, they were less likely to be significantly motivated to enrol for the sciences by the monetary benefits of the policy.

It should be noted that while there was no significant relationship between girls' awareness of the policy and their choice to enrol for the sciences at A-level, boys had a weak correlation. A no significant correlation in this respect means that for the girls, awareness of the policy and choice to enrol for the sciences had nothing in common. For the boys, a weak correlation implied that the Uganda GSBUSP contributed only a small proportion (5%) of the boys' motivation to enrol for the sciences at A-level. Therefore, non-policy related reasons contributed a larger proportion (95%) of influence on the boys' choice to enrol for the sciences at A-level in the period after the inception of the policy.

After establishing that girls' and boys' awareness of the existence of the Uganda GSBUSP had very little to do with their choices to enrol for the

sciences at A-level, the next question was: what then influenced the students' choices as they ignored the GSBUSP, yet the policy offered presumed benefits at the university level for those who opted for the sciences at A-level? The reasons responding to this question are explained in the next sub-section.

#### ***4.5.5 Students' reasons for not using the GSBUSP as a motivation for choosing the sciences***

Reasons why the Uganda GSBUSP did not appear to influence girls' and boys' choices to enrol for the sciences at A-level were identified through interviews with the different key informants and students' FGDs. The reasons are presented as follows.

During the FGDs and the interview sessions, girls and MoES officials noted that girls, more than boys, have other alternative gender-sensitive sponsorship sources for university education besides the government science-based university sponsorship. In support of this view, one girl from Akwali S.S.S said “...*more international and local science scholarships are available for us girls, with specific slots already allocated to us, not like this one where all of us with the boys are competing openly...*” One MoES official agreed with the girl's view when he said:

...the girl child is now motivated to enrol for sciences more than the boy child by the many interventions that promote her education like the Female Initiative Scholarship for increasing female undergraduates in science programmes and others...  
(IDI: A male MoES Official, 18/12/2011)

The aforementioned excerpts reveal that girls are aware that the GSBUSP allocates no special slots to cater for them. The gender insensitive nature of the

Uganda GSBUSP may, therefore, be making the policy less attractive for the girls. The above excerpts further suggest that girls are motivated to enroll for the sciences by pro-female university sponsorship alternatives. Aramanzan and Mutuwa (2005) confirm that in Uganda, some girls study the sciences at the university level using pro-female sponsorships from Non-Government Organizations (NGOs). They also attest to the fact that sponsorship with active positive discrimination in favour of female students had significantly increased girls' participation in the two faculties of ICT and Agriculture in Makerere University.

Most career teachers, mothers, fathers, girls and boys interviewed were keen to portray the policy as mainly being attractive to students from poor families. In the selected schools, on average, more than 70% of the students came from well to do families, and less than 30% of them came from poor families (Table 4.3). Students in the FGDs and other key informants in the interview sessions indicated that girls and boys from well to do families do not bother about the policy provisions that are mostly tied to monetary benefits, which their parents can easily afford. One boy from Ngoi Mixed S.S.S said “... *sponsorship is not the reason for choosing to study sciences because most of our parents can afford to pay for university education...*” In explaining the irrelevance of the fees waiver components entailed in the policy to some of the students, one careers teacher said:

...when you encourage them to compete for the sponsorship, they will show you their pockets ...meaning even if they don't qualify for government sponsorship they can afford to go for

their courses of interest on private sponsorship...(IDI: CTr:  
Okodi Boys' S.S.S,4/10/2011)

These excerpts reveal that in cases where students perceive that their parents can afford university education, the policy becomes insignificant in influencing their choice of what they want to study at A-level. This scenario undermines the utility value explained by Eccles' (2005) Subject-Task –Value Theory as a reason that would influence girls' and boys' decision to enrol for the sciences at A-level. This probably is because the sponsorship benefits being offered by the GSBUSP are effective in motivating learners to participate at lower levels of education than at the higher levels. For example, Frenzel, Dimitrov and Voigts (2013) in Bangladesh, Fermeersch and Kremer (2005) in Kenya and Sutherland-Addy (2002) in Ghana found that at the lower levels of education, food, clean drinking water and nutritious porridge served as incentives for parents to send their offspring to school other than keep them at home to do chores. However, meals, which are highly treasured in the primary and pre-primary schools, were the least preferred policy benefit in by students in this study.

In summary, there was no significant relationship between girls' awareness of the policy and their choice to enrol for the sciences at A-level. In the case of boys, there was a significant but weak negative correlation between their awareness of the policy and their choice to enrol for the sciences at A-level. The influence of the boys' awareness of the policy contributed only 5% to their motivation to enrol for the sciences at A-level. Thus, most students chose to ignore the policy as they enrolled for the sciences at A-level because some of

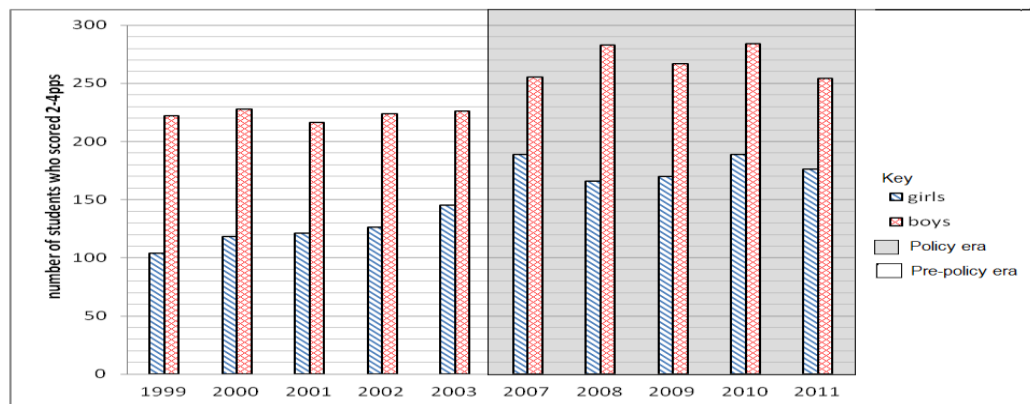
them, especially, girls, had other more attractive sponsorship options than what was being offered by GSBUSP. The policy was also seen to be offering lower level benefits including meals and accommodation that most A-level students did not value. Also, for students coming from higher socio-economic status homes, they had assurance that their parents will afford any fees demanded at the university and, therefore, saw no need to aspire to benefit from the policy. Now, for students who choose to enrol for the sciences at A-level in order to benefit from the policy, the question then is: Does the number of girls and boys performing well in the sciences at A-level increase after the inception of the GSBUSP? The next section addresses their answer to this question in details.

#### **4.6 Comparing Girls' and Boys' Performance in the Sciences Before and After the GSBUSP**

The purpose of the third objective was to compare the number of girls and boys who obtained good grades (performed well) by scoring between 2 to 4 Principal Passes (PPs) in their respective science combinations before and after the introduction of the GSBUSP. In Uganda, Senior Six students normally study and sit final examinations in a minimum of three and a maximum of four subjects as components of any given science combination studied at A-level. An excellent student is expected to pass all the respective subjects in his or her science combination, thus obtaining a maximum of four Principal Passes (4PPs). A student qualifies to obtain a principal pass in any given subject if he/she scores a minimum average mark of 40% in that subject. If a student obtains between 2 to 4 PPs in his/her subject combination, he/she is considered to have performed well (obtained good grades) because 2PPs is the minimum

number of Principal Passes required for admission into any public university in Uganda (MoES, 2004). However, 4 PPs is the maximum number of Principal Passes an A-Level student can obtain as the excellent university entry score. A student who obtains one or no Principal Pass (PP) in his/her A-level science combination is considered to have performed poorly, and is not eligible for admission into any university to pursue an undergraduate degree course.

In order to understand how girls and boys performed in the sciences at A-level before and after the policy introduction at A-level, the trends that show the number of students who performed well as provided by the schools' directors of studies is shown in Figure 4.4.



Source: Summary of data from school records (2011)

#### **Figure 4.4 Trends of girls' and boys' performance before and after the policy inception**

The performance trends of students in Figure 4.4 shows that there was a general increase in the number of girls and boys who performed well (obtained 2-4 PPs) in the sciences at A-level before and after the inception of the Uganda GSBUSP. However, the number of girls who obtained high scores remained

lower than that of boys in the two eras. The lowest number of girls who obtained high scores in the sciences in the pre-policy era was 104 (92.9%) in 1999 while that of the boys was 222 (91.7%) in the same year as shown in appendix XI. The highest number of girls who obtained high scores in science in the same period was 145 (94.8%) in 2003, while that of the boys was 226 (88.6%) in the same year. These figures show an increase rate for girls of 3.1% and a decrease of -4.3% in the proportion of boys who obtained high scores in the era before the policy inception. The trend in the students' performance in the era before the policy inception shows that the increase rate in the number of girls who obtained high scores in the sciences was higher than that of boys.

In 2007, three years after the inception of policy, the number of girls who performed better in the sciences at A-level was 180 (94.7%) while that of the boys was 255 (92.1 %) in the same year as shown in Appendix XI and Fig 4.4. The number of girls who obtained high scores in the sciences in the year 2011 of the same era was 181 (87.9%), while that of the boys was 245 (83.6%). These figures show a decrease rate of -6.8% in the number of girls who obtained high scores, while that of the boys decreased at a rate of -8.5% in the period after the inception of the policy. These enrolment trends reveal that the decrease rate in the proportion of girls who obtained high scores in the sciences after the inception of the policy was lower than that of boys. However, it should be noted that although the rate of decrease in the number of girls who obtained high scores in the sciences was lower than that of boys, their mean

numbers remained lower than that of the boys both before and after the inception of the GSBUSP.

Overall, these findings indicate that the proportion of students who obtained high scores in the sciences reduced for both genders in the period after the inception of the policy. This decline was higher for the girls because they experienced a -6.8% rate of decline in the policy era as opposed to the 3.1% rate of increase in the pre-policy era. The reasons for the decline in the proportion of girls who obtained high scores in science examinations in the era after the inception of the policy are explained in the next sub-section.

#### ***4.6.1 Reasons for the decline in the number of girls performing well in the sciences***

The study participants provided two reasons for the decline in the number of girls who performed well in the final A-level (UACE) science examinations after the inception of the GSBUSP (2007-2011).

The use of standardized exam scores in the recruitment of students was one of the reasons provided for the decline in the number of girls performing well in the sciences. Four out of six careers teachers and two of six head-teachers were of the view that the recruitment of students for the A-level science combinations exclusively on the basis of the standardised final O-level scores resulted in the admission of even weak girls. They explained that students who do well in the standardised final exams do not necessarily perform well in the schools' continuous assessment tests. The following is what one careers teacher had to say:

...in the years when we had a number of Senior Six girls failing, it was partly because we had admitted many students who chose to study sciences at A-level because they had passed the O-level final examinations regardless of their poor performance in the school's continuous assessment tests... (IDI: HTr: Akwali Girls S.S.S, 5/10/2011)

Consequently, such students, according to one careers teacher from Ngoi S.S.S, “... end up doing poorly in their A-level final examinations because they were never good in these subjects even in the course of their O-level...”

These excerpts imply that girls who choose to study the sciences at A-level because of their good scores in the final O-level examinations (Uganda Certificate Examinations -UCE) regardless of their poor grades in the schools' continuous assessment tests do not perform equally well at A-level.

Secondly, pressure from parents and peers made girls to opt to study the sciences at A-level even though their O-level grades had proved they were better in arts than in the sciences. One head teacher and two careers teachers explained that weak students insist on doing the sciences because of pressure from parents and peers. According to them, parents and peers who pressurise girls who are weak in sciences say to them:“...*doing sciences is trendy, jobs are available for scientists in the labour market, there is less competition for government sponsorship in the science courses...*”These excerpts suggest that many girls may have enrolled for the sciences in the policy era to please other people and not out of their own interest. As a result, many of them may fail the A-level final science examinations. This resulted in the decline in the number of girls who performed better (scored 2-4PPs) in these years. This view is supported by Adams (1996), who found that in the USA, girls contemplating a

career in the sciences find it difficult to look to the future to make career plans based on their interests rather than the mandate of influential persons, especially their parents. Adams also confirmed that such girls do not work hard to perform better in the sciences since they are not interested in it.

The performance of girls and boys in the sciences at A-level before and after the introduction of the GSBUSP in terms of their mean percentages and numbers is presented in Table 4.8.

**Table 4.6 Girls' and boys' performance in the Sciences at A-level by frequencies and percentages**

		Girls			Boys		
		2-4PP	0-1PP	Total	2-4PP	0-1PP	Total
Before policy inception (1999– 2003)	Mean number of students' performance	122.8	7.0	129.8	223.2	23.6	246.8
	Mean % of students performance	94.6	5.4	100	90.5	9.5	100
After policy inception (2007–2011)	Mean number of students' performance	177.2	16.6	193.8	266.8	39.4	306.2
	Mean % of students' performance	91.5	8.5	100	87.3	12.7	100

Table 4.6 indicates that on average, the proportion of girls (91.5%) and boys (87.3%) who performed well in the A-level final science examinations in the period after the inception of the policy was less than those of the pre policy era (94.6% for girls and 90.5% for boys). However, these proportions do not reflect the actual average number of students who performed well in sciences after the inception of the policy, because more girls (from 122.8 to 177.2) and

boys (from 223.2 to 266.8) obtained high scores in the sciences in this era. In this context, the girls' and boys' bigger proportions in the pre-policy era are as a result of having smaller overall total numbers in this era than after the inception of the policy. This observation implies that more girls and boys performed better in the era after the inception of the policy than before. In order to confirm this observation, the statistical difference between the number of girls and boys who performed well in sciences before and after the inception of the GSBUSP was established by subjecting their respective mean numbers in the two eras of the policy to a t-test using the following null hypotheses.

*Ho7 There is no significant difference in the numbers of girls who obtained 2-4 PPs in the sciences at A-level before and after the inception of the GSBUSP at .05 level of significance.*

A *t-test* for independent groups was used to establish the difference between the mean number of girls who performed well (obtained 2-4PPs) in the sciences before (122.8) and after (177.2) the introduction of the policy as shown in Table 4.6. The t-test results ( $t = 7.897$ ;  $p < 0.01$  as shown in Appendix IX) revealed a statistical difference. The null hypothesis in this case is rejected and the alternative accepted because the p value is less than .05. This means that the introduction of the policy might have led to increases in the number of girls who performed better in the A-level science final examinations.

Similarly, a *t-test* for independent groups was used to establish the difference between the mean number of boys who performed better (obtained 2-4PPs) in

the sciences before (223.2) and after (266.8) the introduction of the policy (Table 4.6) using the following hypothesis.

*Ho8 There is no significant difference in the numbers of boys who obtained 2-4PPs in the sciences at A-level before and after the inception of the GSBUSP at .05 level of significance.*

The t-test results revealed a significant difference ( $t = 5.698$ ;  $p < 0.01$  as shown in Appendix IX). In this result the *t-statistic* is less than 0.05, we reject the null hypothesis and accept the alternative. This means that the introduction of the policy might have led to increases in the number of boys who performed well in the A-level science final examinations.

The *t-test* results for hypothesis seven and eight reveal that the mean number of boys and girls who enrolled in the sciences at A-level in the era after the policy inception was significantly more than that of the pre-policy era. However, in the case of proportions, the average percentages of girls and boys who performed better (obtained 2-4 PPs) in the sciences at A-level dropped by 3.1% for the girls and 2.7% for boys in the period after the policy inception as shown in Table 4.6. These drops should not be used to conclude that the number of girls and boys who obtained high scores in the A-level science examinations in the era after the inception of the policy is less than those of the pre-policy era. The decrease in the proportion of girls and boys who obtained high scores in the era after the inception of the policy is due to the fact that the mean number of students who sat examinations in this era is far much higher (193.8 for girls & 306.2 for boys) than those of the pre-policy era (129.8 for girls & 246.8 for

boys). The rule of the thumb is: smaller numbers yield high proportions while bigger numbers do the opposite.

Table 4.6 also reveals that in the period before the policy inception, the mean percentage of girls who performed well in the sciences at A-level was higher (94.6%) than that of the boys (90.5%) by 4.1%. Even after the inception of the policy, the mean percentage of girls who performed well in the final A-level examinations was more (91.5%) than that of the boys (87.3%) by 4.2%. This implies that proportionally, more girls than boys performed well in the sciences before and after the introduction of the policy. These percentages may be deceptive. The deception is brought about by the fact that girls registered lower enrolment figures both before and after the inception of the GSBUSP (see Table 4.6), and this had the potential to inflate their percentages as compared to those of the boys. The bigger proportion of girls who obtained high scores in the era before after the inception of the policy is due to the fact that the mean numbers of the girls who sat examinations in these two eras are far much smaller (129.8 & 193.8 respectively) than those of the boys (246.8 & 306.2 respectively). The rule of the thumb is: smaller numbers yield high proportions while bigger numbers do the opposite. For example, in the pre-policy era, the mean number of girls enrolled in the sciences of 122.8 was represented by a percentage of 94.6%, while for the boys; the mean number of 223.2 was represented by a percentage of 90.5%. The rule of thumb, therefore, suggests that we retain the position that in the two eras of the policy, more boys than girls enrolled in the sciences at A-level as indicated by the mean numbers shown in Table 4.6. In order to confirm this finding, the statistical significant

difference between the number of girls and boys who performed well in the sciences before and after the inception of the GSBUSP was established by subjecting their respective mean numbers in the two eras of the policy to a *t-test* using the following hypothesis.

*Ho9 There is no significant difference between the mean numbers of girls and boys who performed well in the sciences at A-level before the inception of the government science-based university sponsorship policy at .05 level of significance.*

A *t-test* for independent groups was used to establish the difference between the mean number of girls (122.8) and boys (223.2) who performed well in the sciences before the introduction of the policy (Table 4.6). The *t-test* results revealed a statistically significant difference between the mean number of girls and boys who obtained high scores before the inception of the policy ( $t = 15.745$ ;  $p = 0.01$  as shown in Appendix IX). In this result, since the *p* value is less than 0.05 the *t statistic* is significant, the null hypothesis is rejected. Thus, the conclusion is that there is a significant difference between the mean number of girls and boys who performed well in the sciences before the inception of the policy in favour of boys.

Similarly, after the introduction of the policy, the mean number of girls (177.2) who performed well in the sciences at A-level was compared to that of boys (266.8) by testing the following hypothesis.

*Ho10 There is no significant difference between the mean numbers of girls who performed well in the sciences at A-level after the inception of the*

*government science-based university sponsorship policy compared to that of the boy's at .05 level of significance.*

The t-test results revealed a statistically significant difference between the mean number of girls and boys who obtained high scores after the inception of the policy ( $t = 9.709$ ;  $p = 0.03$  as shown in Appendix IX). Since the p value is less than 0.05, the *t statistic* is significant, the null hypothesis is rejected. Thus, the conclusion is that there is a significant difference between the mean number of girls and boys who performed well in the sciences after the inception of the policy in favour of boys. This means that the introduction of the policy might have led to a higher increase in the number of boys who performed well in the sciences in the era after the inception of the policy than that of the girls.

Key informants like District Inspectors of schools and science teachers confirmed that in the policy era, fewer girls than boys were performing better in the sciences at A-level. One male District Inspector of schools from Oketi District said; *“even in the recently (2010) released A-level exams, more boys than girls performed well in the sciences”* A science teacher from a co-educational school also agreed that fewer girls than boys were performing better when he said *“... although you can find girls participating actively in class and outperforming boys in class work, generally boys' performance is better than that of girls in final examinations...”*

#### ***4.6.2 Why fewer girls obtained good scores in the Senior Six final science examinations***

The study participants acknowledged that various factors were at play to perpetuate girls' under performance in the sciences at A-level as compared to the boys as explained below.

Home chores were identified as one of the reasons that hindered more girls than boys from concentrating on their academic work. The type of house hold chores that girls do leave them either too tired or with no time to revise and do homework. One girl from Aguzu Mixed S.S.S in an FGD said; *"I have no time to read at home because my parents cannot afford a house girl, so besides being a student, I am also the house girl who has to cook, clean the home and wash clothes."* A father from the same school held a similar view when he said *"... the type of domestic work girls do does not allow them to revise while the boys' work allows them to revise ..."* A male careers teacher from Aguzu Mixed S.S.S confirmed this view when he explained that *"... girls' work tends to be concentrated around cooking, cleaning the compound, and fetching water, which is not done by the boys..."* This domestic work, as noted by a girl in one of the FGD sessions at Aguzu Mixed S.S.S *"...leaves girls tired and with no room to concentrate on their books..."*

The above excerpts point to the fact that although girls and boys are expected to compete comparably in the sciences at A-level, the conditions on ground favour the boys, who are given more time to study than the girls. While boys have time for revision, girls are overburdened with domestic work.

Girls' lack of adequate science-based experiences to build upon in class was another reason that was advanced for fewer girls' performing well in the sciences as compared to boys. This view was demonstrated by one father from Akwali Girls SSS who said "... *customs like girls should not climb trees, slaughter animals, or be seen roaming in the community by doing errands like buying things from shops limit their exposure to scientific experiences at home...*" Boys, on the other hand, are given a chance to discover by running errands and doing other home chores, which favour their mastery of concepts in science and mathematics lessons. In explaining this view, one male science teacher said:

...boys know how to count and get balance when they are sent to the shops ... when you teach about the digestive system, the boys know it since they slaughter domestic animals like goats and birds like chicken but the girls even fear the blood ... (IDI: A Tr: Ngoi Mixed SSS, 26/10/2011)

These responses imply that boys more than girls, have an environmentally-induced advantage in math and science, even before they are introduced to these subjects in school. This view is supported by Guzzeti and Williams (1996) and Woolfolk (1998) who also found that the home experiences of the boys in the USA provide more opportunity for the development of their spatial visualisation and basic maths and science skills than those of the girls. This view indicates that the girls are also exposed to science-based experiences in their home chores. For example, according to Kakinda (2007) scientific concepts like oxidisation, combustion, pollination in plants, measurements in proportions, temperatures, among others, are all found among the girls' home chores such as cooking and gardening that society has traditionally assigned to

them. However, the girls' home-based science experience tends to be ignored by the school curricula. This view is supported by Mulemwa (1997), who found that in African countries, most curriculum content in the schools tends to build on the experiences of boys and men, while ignoring those of the girls and women. This research too, found out that the ratios of the female to male A-level science teachers in the respective schools were about 1: 6, meaning that the predominantly male A-level science teachers will tend to use examples from their own male experiences while ignoring those of the girls.

In addition, six girls in the FGD sessions said that some male teachers and boys discouraged their ambitions to excel in the sciences through discouraging utterances like: *"sciences are not meant for you go get married"*, *"stop disturbing me"*, *"I don't know why you are studying yet you are going to fail S.6 and get married"*, *"girls never succeed when they attempt to do sciences, they give up on the way"*, *girls who succeed may be witches or have manliness in them"*. These excerpts reveal that teachers and peers who treat girls in science classes harshly do extend the society's gendered assumptions within the school. Similarly, Kessels' (2005) study in Germany and Whittock's (2002) study in Northern Ireland found that male teachers and peers who uphold cultural attitudes and values treat girls and women in the science disciplines harshly as a way of discouraging them from feeling at home in a traditionally male domain. According to Asimwe (2008) girls in O-level science classes in such a situation cope by either asking very few questions, or not asking them at

all. In addition, Asiimwe confirmed that girls' passive participation in the lessons negatively affects the quality of their performance in the sciences.

Students in the FGDs and teachers who were interviewed identified girls' passive role in science practicals as another reason that contributed to their low grades in science final examinations. One male science teacher from Aguzu Mixed S.S.S acknowledged this view when he said “... *in my lessons in the laboratories, most of the practices are carried out by boys because girls ‘take a back seat’ for various reasons ...*” One boy from Ngoi Mixed S.S.S confirmed the science teacher's statement as follows: “... *during practicals, many girls are cowards and hardly dissect frogs, rats and insect specimen in Biology practicals like the boys...*” A girl from Aguzu Mixed S.S.S was of the same view when she said:

... in this school, girls more than boys are scared of the chemical reactions and hate the pungent smell of gas and burning chemicals in chemistry practicals ... they can never even record accurate observations in their reports and this lowers their grades in the practical examinations... (FGD: A girl: Aguzu Mixed S.S.S, 15/10/2011)

These excerpts indicate that while boys take a much more active role in science experiments, most girls remain passive. This could be because girls have been conditioned by cultural beliefs to fear and ran away from anything harmful or unpleasant while boys are encouraged to be daring. In agreement with this view, the OECD report (2007) confirmed that in European countries, girls were mere observers during experiments, while boys were comfortable in different science-related experiments due to gender stereotype beliefs that allocate a masculine label to the science field. Girls' passive nature during science

practicals makes them to under-perform in the sciences since they lose out on the much needed practical experience in science. This view is supported by Sandler and Hall (1986), who confirmed that in the USA, students' constant practice in practical science activities translated into better performance in a given subject area. This was because students who participated actively in the classroom setting benefitted the most from instructing experience.

Furthermore, during interviews with teachers, both male and female science teachers were of the view that teachers who perceive girls as less intelligent discourage girls from performing well in the sciences. They explained that such teachers expect boys to respond to their questions more effectively than girls during science lessons. Consequently, these teachers pay more attention to the boys in the science lessons. This view was illustrated by one male teacher from Ngoi Mixed S.S.S when he recounted his personal experience as follows:

...when a girl delays to answer a question, they usually do not know the answer, so I quickly pass the question to a boy because I expect them to usually answer immediately and correctly. In case he delays, I ask the question in another way because I imagine he knows the answer but hasn't understood it well...

The study participants reported that girls tend to adopt the teachers' low expectations of them in science by becoming inactive in the science classes as illustrated by the following excerpts: A girl from Aguzu Mixed S.S.S said "... *because some science teachers do not expect girls to respond to their questions, they mostly direct them to boys ...we also just remain quiet and play the fools they take us to be ...*" A female official from MoES shared the same view when she observed that "...*when girls see the science teachers always*

*assigning more questions to boys, the majority of the girls simply observe and are content to let the boys do the responding ...*” These excerpts indicate that girls became less active in the science classes due to the teachers’ gender insensitive question distribution approach which ignored them.

The above finding is in agreement with Karabel and Halsey’s (1977) view that the ‘teacher-expectancy effect’ theory operates in such a way that when teachers communicate their expectations of students with various gestures, the students tend to adopt them so that they become fulfilled. In the current study, the ‘teacher-expectancy effect’ refers to the teachers’ perception of girls as less intelligent. In the current study, the teachers communicated their perception of girls as less intelligent through the allocation of questions to students in a gender insensitive manner that favoured boys. As a result, girls chose to become inactive in the lessons of such teachers. The teachers’ discriminative gesture against girls discouraged their participation in class while promoting that of the boys. The gist of this point is that the teachers’ discriminative behaviour against the girls does not promote learning among the girls because it is through students’ answers to questions that a teacher is able to point out what is incorrect or weak about their answer (Teaching Center, 2009). Girls who hardly answer questions in class lack the opportunity to learn correct science concepts from the teacher.

Girls’ cultural upbringing was expressed by the study-participants as one of the reasons for their under-performance in the sciences as compared to the boys. A male teacher said that girls are trained to be anti-social through the strict up-

bringing and rules they are often given at home such as ‘... *stay away from boys, men and strangers as much as possible ...*’ The implication here is that girls miss out a lot when they keep to themselves while boys interact with ease, share information and knowledge, and learn from many other people. A male MoES official further noted that ‘... *girls do not ask for help from male teachers...neither do male teachers follow up and mentor girls to ensure that they perform well because they fear that people may suspect them of sexual harassment or love relationships ...*’ This matter also becomes critical when one considers the fact that girls often need a lot more assistance in the sciences than boys because of the various reasons discussed above, yet they and the science teachers, who are mostly males, are not free to interact with each other for the relevant additional support.

Participants did point out that some teachers are not qualified, and cannot teach students properly because they are not skilled in these subjects. A head-teacher from Aguzu Mixed S.S.S said: ‘...*teachers tend to lecture-heap students with notes and move with the fast learners leaving the slow learners frustrated. In such cases, a girl without determination and courage gets discouraged and loses the stamina to excel...*’ A girl from the same secondary school said ‘*teachers do not relate the abstract science concepts to our daily life...like fermentation of cassava or distillation of local brew...*’ Expounding on the poor methods of teaching, another girl from Akawli Girls’ S.S.S said ‘... *even some teachers do not understand these concepts so they load the concepts on you in an un-simplified manner...*’ Such poor methods of teaching

do not enhance better understanding of science concepts among students. Consequently, the learnt science concepts remain abstract, and this re-enforces the fallacy among students, especially the girls, that the sciences are hard. This finding implies that poor teaching of the sciences at all levels of education contribute to students' poor performance in the sciences, especially among girls who need teaching methods that make science doable rather than undoable.

Some career and science teachers also pointed out that not all teachers are competent in setting successful practicals for students, and that such teachers avoid practical lessons and make science subjects theoretical. This inability arises from the fact that many mathematics and science teachers did not perform well in these subjects themselves, and yet, they have to teach them at school. The interviewees pointed out that in some schools, teachers who teach in the lower classes are not well qualified to teach science and mathematics, and they do not create interest in the students at an early stage. The trend of the discussion here was that if the above is true, then by the time the girls get to study the sciences in the upper classes, they would have already had a poor foundation.

Science teachers and students noted that inadequate facilities like laboratories and science equipment prohibit students from participating actively in science lessons. When facilities are few, students end up scrambling for them and often, the non-scramblers become indifferent and passive in such situations. One male science teacher from Ngoi Mixed S.S.S noted “...*when facilities are*

*few there is always a scramble for them and boys end up monopolising the instruments and equipment so they end up getting more practice and learning experiences than the girls ...*” This excerpt implies that when science facilities are inadequate, girls’ chances of utilising them for learning are much less than those of the boys.

In summary, though the girls’ and boys’ mean enrolment percentages increased after the inception of the policy, their mean performance percentages dropped in the same period, with girls registering a worse decline of -3.1%. However, the drop in the mean percentages of the girls and boys who obtained good grades in the period after the inception of the policy was due to the fact that the mean numbers of girls and boys who sat examinations in the pre-policy era were much smaller than those of those of the policy era. The rule of the thumb is: smaller numbers yield high proportions while bigger numbers do the opposite. Significantly, more boys than girls obtained good grades (performed well) in the sciences in the periods both before and after the inception of the policy. On average, 100.4 (223.2-122.8) more boys than girls obtained good grades in the A-level final science exams in the pre-policy period while 89.6 (266.8-177.2) more boys than girls performed well in the sciences in the period after the inception of the policy. The reasons for fewer girls than boys obtaining good grades in the A-level science final examinations were both school-based and non-school based. It should also be noted that the mean numbers of students who performed well in the sciences after the inception of the policy rose significantly by 55.4 (from 122.8 to 177.8) for the girls and

43.6 (from 266.8 to 223.2) for the boys. The reasons for the increase in the mean number of girls who obtained good grades in the final A-level sciences examinations in the period after the inception of the GSBUSP may range from those related to benefiting from the policy to other factors. A clearer answer to this scenario is the subject of discussion in the next sub-section.

#### **4.7 Students' Awareness of the GSBUSP and their Performance in the Sciences**

This section addresses the fourth objective of the study and presents findings on the influence of the Government's Science-Based University Sponsorship Policy (GSBUSP) on girls' performance in the sciences at A-level vis-à-vis that of the boys. The objective was based on the stipulation in the GSBUSP that only students who pass the sciences at A-level will be selected to benefit from its sponsorship in public universities. The key question this objective addressed in students' performance in the sciences at A-level was: "does awareness of the monetary benefits in terms of tuition fees waiver, free accommodation, faculty fees and meals entailed in the Uganda GSBUSP influence girls to perform better in the sciences at A-level compared to the boys?" To generate data for this gender comparison, girls and boys were asked to indicate whether the policy and its specific sponsorship benefits were the reason they worked hard to obtain good grades in the sciences at A-level. Their responses are summarised in Table 4.9.

**Table 4.8 Components of GSBUSP that potentially motivated girls and boys to perform well in science**

Policy components	Girls				Boys			
	Yes		No		Yes		No	
	f	%	f	%	f	%	f	%
The GSBUS	66	83.5	13	16.5	73	91.2	7	8.8
Tuition fees	62	78.5	17	21.5	66	83.5	13	16.5
Free meals	18	22.8	61	77.2	27	33.8	53	66.2
Free accommodation	41	51.9	38	48.1	43	53.8	37	46.2
Faculty allowance	48	60.8	31	39.2	54	67.5	26	32.5

*Source: Field data (2011)*

Looking at the specifics of the sponsorship, Table 4.9 shows that a relatively larger proportion of boys (83.5%) as compared to the girls (78.5%) indicated that they were motivated to work hard to score good grades in the sciences because of tuition fees. Meals were the least reason indicated by both girls (22.8%) and boys (33.8%). Table 4.9 further shows that fewer girls (83.5%) than boys (91.2%) indicated the GSBUSP sponsorship scheme as the reason why they worked hard to perform well in the sciences at A-level. Despite the fact that fewer girls than boys were motivated by the GSBUSP, considering the proportions within the girls' category alone, it is evident that the majority (83.5%) were motivated to perform better in the sciences by the GSBUSP sponsorship scheme.

#### ***4.7.1 Linking the GSBUSP to motivation of girls and boys to perform better in the sciences***

The findings suggest that the reasons why the GSBU sponsorship scheme motivates girls and boys to perform better in the sciences at A-level range from personal to external ones as explained below.

The majority of teachers (eight science teachers and four careers teachers) interviewed and students in the FGD sessions were of the view that the students' qualification for government sponsorship is a sign of success and a source of pride for their schools. Three participants expressed this view as follows: *"...when many of your students qualify for government sponsorship, then your school is going to be rated highly- as a good performing school..."*(IDI: A male CTr: Ngoi; 8/12/2011). Another one reported that *"...we normally compare ourselves with other schools and we see how many students are taken for government sponsorship, those with many government sponsored students are rated as the best performing schools..."* (IDI: A female CTr: Akwali Girls' S.S.S; 5/10/2011). While another noted that *"...we work hard to qualify for government's university sponsorship so as to keep the image of the school's excellence in academics..."* (FGD: A boy: Ngoi Mixed S.S.S; 15/10/2011).

District and Ministry of Education Officials also expressed the view that many people in society perceive qualifying for government's university sponsorship as a yardstick for students' good performance in the A-level final exams, and

they also view it as a source of prestige. In explaining this view further, one

Inspector of Schools noted:

...students are working hard to pass sciences well at A-level because they associate qualifying for government's university sponsorship with good performance and missing it with failure and they do not want to bear the shame of being regarded as failures by their friends... (IDI: A male District Inspector of schools: Okoti District; 16/12/2011)

In the following recount of his experience, one boy supported the District

Inspector of schools' view above:

...my father has pleaded with me to perform better to qualify for government's university sponsorship for prestigious reasons. He says even if he is going to sponsor my university studies abroad, he wants me to be among those whose names will appear in the newspapers as an excellent student who qualified for government sponsorship for his friends to know that he has an intelligent child ... (FGD: A boy: Ogudu Boys' S.S.S; 5/10/2011)

Girls in the FGD sessions also said that they were working for government's university sponsorship because being eligible for it was associated with good performance. Two girls summarised their views as follows: "... *my ambition to qualify for government sponsorship is for making my parents proud...*" and "...*am working for government sponsorship so as to please my parents ... as this is the evidence of excellent performance...*"

Several study participants acknowledged that students from low socio-economic status (LSES) backgrounds were motivated to perform well in the sciences at A-level as a means of accessing the Uganda GSBU sponsorship for university education. Expounding on this view, a male teacher interviewee recounted the experience of one of the students in his class:

...a girl told me how her guardian told her that even if she picked private sponsorship forms, he would not be able to pay for her. So she had to read hard to make it on government's university sponsorship... (Akwar Girls' S.S.S)

The above excerpt echoes the utility value consideration that Eccles (2005) conceptualises as one of the factors that motivates students to perform well in a given task. In the utility value consideration context, students' choice to perform well in a task is used as a means for attaining some other short or long term goal. Therefore, some students use working hard to perform well in the sciences at A-level as a means for qualifying to benefit from the Uganda GSBU sponsorship scheme.

Head-teachers and students were of the view that some girls and boys were working hard to qualify for the Uganda GSBU sponsorship in order to save their parents from the burden of paying fees, and to be able to "partake of the national cake." Two students expressed this view as follows:

...most girls in this school can afford private sponsorship, but they work hard to pass well to qualify for government's university sponsorship as a thank you token to their parents who have paid school fees from nursery school till now... (FGD: A girl: Ngoi Mixed S.S.S; 26/10/2011)

A boy from the same school reiterated the same sentiment when he said

...When you perform well to be sponsored by your government, you feel proud about it, that you are relieving your parents from the burden of paying tuition fees and enabling them to gain from government's funding...(FGD: A boy: Ngoi Mixed S.S.S;26/10/2011)

During a parents' meeting with A-level students, one male Head-teacher from Okodi Boys' S.S.S said:

...many of you can afford university tuition fees, but I beg that you encourage your children to work hard to qualify for government's university sponsorship as one avenue to benefit from government's national cake-funding for your child's education...

#### ***4.7.2 The extent to which the GSBUSP motivated girls to obtain good grades in the sciences***

The excerpts in the above section indicate that the GSBUSP motivated A-level girls and boys to perform better in the sciences. However, the findings in the excerpts do not indicate the extent to which A-level students' awareness of the GSBUSP motivated them to obtain good grades in science examinations. Hence, it was necessary to use a statistical test to establish whether there was a significant relationship between girls' and boys' awareness of the GSBUSP and their performance in the sciences. In the statistical test, the scores on students' GSBUSP-related reasons for working hard to excel in the sciences at A-level were correlated with the actual scores on the grades they obtained in the A-level science mock examinations. It is on this basis that the following hypothesis was tested.

*Ho11 There is no significant relationship between girls' awareness of the government's science-based university sponsorship policy and their performance in the sciences at A-level at .05 level of significance.*

A Pearson Product Moment Correlation Coefficient (r) was used to establish the relationship between girls' awareness of the policy and their performance in the sciences at A-level. The results are summarised in Table 4.10

**Table 4.9 Relationship between girls' awareness of the policy and their performance in sciences at A-level**

		Correlations	
		Girls' awareness	girls principle passes
Girls' awareness	Pearson Correlation	1	.061
	Sig. (2-tailed)		.590
	N	80	80
girls principle passes	Pearson Correlation	.061	1
	Sig. (2-tailed)	.590	
	N	80	80

Table 4.10 shows a positive weak and not significant correlation ( $r = 0.06$ ;  $p = 0.590$ ) between girls' awareness of the policy and their performance in the sciences at A-level. Since the  $p$  value observed here is greater than 0 .05 level of significance, it implies that the hypothesis that there is no significant relationship between girls' awareness of the government science-based university sponsorship policy and their performance in the sciences at A-level is retained. This means that the awareness of the policy does not significantly influence girls' performance in the sciences at A-level. The positive weak but not significant correlation result means that even the available prospect that awareness of the policy influences girls' performance in science at A-level is too small to be noticed.

This result reveals that becoming beneficiaries of the fees waivers entailed in the policy is not a strong motivator for girls to perform well in the sciences at A-level. In this context therefore, the influence of the utility value on girls'

performance in the science at A-level is not significant. Presumably, there could be other factors that influence girls' performance in the sciences at A-level. This means that for Uganda's GSBUSP to significantly influence girls' performance in the sciences at A-level, it may need to broaden its sponsorship package to include components that remarkably enhance girls' performance in the sciences. Such components may include sponsorship of remedial courses in science and mathematics and sponsoring the equipping of secondary schools with science kits, and training science teachers in using the kits well. In Tanzania, sponsorship of remedial courses in mathematics and sciences greatly improved the performance of borderline female candidates in the STM university programmes (Masanja, 2001). In South Africa, sponsoring the equipping of secondary schools with science kits and training science teachers to use them well significantly increased the number of African and coloured female learners passing mathematics and science (PMG, 2004).

With regard to the boys, the following hypothesis was used to establish the relationship between their awareness of the policy and their performance in the sciences at A-level.

*Ho12 There is no significant relationship between boys' awareness of the government's the science-based sponsorship policy and their performance in sciences at A-level at .05 level of significance.*

A Pearson Product Moment Correlation Coefficient (r) was used to establish the relationship between boys' awareness of the policy and their performance in the sciences at A-level. The results are summarised in Table 4.11.

**Table 4.10 Relationship between boys' awareness of the policy and their performance in sciences at A-level**

		Correlations	
		Boys' awareness	boys principle passes
Boys' awareness	Pearson Correlation	1	.064
	Sig. (2-tailed)		.573
	N	80	80
boys principle passes	Pearson Correlation	.064	1
	Sig. (2-tailed)	.573	
	N	80	80

Table 4.11 shows a positive weak and non-significant correlation ( $r = 0.064$ ;  $p = 0.573$ ) between boys' awareness of the policy and their performance in the sciences at A-level. Since the  $p$  value observed here is greater than 0.05 level of significance, it implies that the hypothesis that there is no significant relationship between boys' awareness of the government science-based university sponsorship policy and their performance in sciences at A-level is accepted. This means that the awareness of the policy does not significantly influence the boys' performance in the sciences at A-level. The positive weak but non-significant correlation result means that even the available chance that awareness of the policy influences boys' performance in the sciences at A-level is too small to be significantly noticeable.

These results reveal that awareness of the policy does not significantly influence boys' good performance in the sciences at A-level. Hence, becoming beneficiaries of the fees waivers entailed in the policy is not the reason that motivates boys to perform well in the sciences at A-level. In this context therefore, the influence of the utility value theory on boys' performance in the science at A-level is not significant. These results, therefore, reveal that there could be other factors that influence boys' performance in the sciences at A-level.

Overall, for both girls and boys, there is no significant influence by the need to benefit from the GSBUSP on their performance in the sciences at A-level. This finding ought to be a point of concern for the Uganda government, since this education policy is meant to enhance human resource in the sciences.

After noting that awareness of the policy had no significant relationship with both girls' and boys' performance in the science at A-level, the question then was: why doesn't the policy significantly motivate girls and boys to obtain good grades in the A-level science examinations? Answers to this question were provided from interviews and FGDs upon which the following section is developed.

#### ***4.7.3 Possible reasons why the Uganda GSBUSP failed to significantly relate with students' performance in science***

Whereas the policy was meant to motivate students to obtain better scores in science examinations, the correlation above does not show it. Different reasons

were advanced by the study participants as key in preventing the policy from meeting its intended target as explained below.

In all their four FGDs, female students were of the view that some girls have a low self-efficacy towards the achievement of high scores required to qualify for government university sponsorship. Commenting on this, one girl said:

... in order to qualify for government sponsorship, one has to score highly, some of us cannot get those many points, so we are studying hard in sciences because we love the subjects and not because we want to qualify for government sponsorship...  
(FGD: A girl: Aguzu Mixed S.S.S, 15/10/2011)

This excerpt reveals that the high intake scores required for one to qualify for the Uganda GSBU Sponsorship has discouraged girls from competing for it because they don't expect to score very high grades in the final A-level examinations. This view was only mentioned by the girls. This finding is a confirmation of Rayman & Brett's (1993) theory that because of their being feminine in a masculine arena, girls feel they have the permission to drop out of the race of performing better in the sciences, unlike the boys who often feel obligated to stay because society and themselves know and believe that the sciences are masculine. DeBacker & Nelson (2000) confirmed that perceiving science as a male domain negatively correlates with achievement and persistence in the sciences by high school girls.

Such girls could probably have been motivated to compete for the GSBU sponsorship if a gender sensitive provision that lowers their university entrance grades was included in the policy package. In Malawi, some girls entered the university through a gender sensitive university admission policy that admitted

them on a slightly weaker footing than boys. These girls worked harder and, in some instances, obtained better grades than the boys (Gomile-Chidyaonga, 2003)

In all the girls' four FGDs, it was stated that some girls are discouraged by the few slots allocated for government sponsorship. One girl expressed this view by stating that:

...the slots are too few for the number of students who pass sciences at A-level, this makes the competition for the few government sponsorship slots so stiff that it is almost only the excellent of excellent students who qualify for it and my performance is not all that good... why bother with such a highly competitive sponsorship... (FGD: A girl: Akwali S.S.S, 5/10/2011)

This excerpt suggests that the few slots available for government sponsorship have intensified the performance competition in the sciences among the A-level students, and this is detested by some girls. In this context, the Uganda GSBUSP has created a discouraging academic atmosphere for some girls. The intense competition for the few government university science slots diminishes some girls' interest in the policy's sponsorship to the extent that they are not pursuing it. Rayman and Brett (1993) in the USA also found that the culture which prides itself on competition and weeding students out is experienced as unreasonably impersonal and hostile by female students. According to Tiffany and Burnette (2004), girls' sustained participation in the sciences depends on supportive rather than eliminative and discriminative mechanisms and policies. This means that girls' ambition to perform better in the sciences is more sustained by reassuring and supportive incentives than the use of competition.

Faced by stiff competition, some girls easily get discouraged and give up their quest to qualify for the GSBUS sponsorship.

The majority of the girls in the FGD sessions spoke of the theoretical and unfulfilling ways in which science subjects are taught as reasons that discourage them from working hard to perform better in the sciences so as to benefit from the GSBUS. In explaining this view, one girl said:

...the practical experiences in the lab are limited to un-motivating experiences which are not fulfilling. The practical lessons we have are more theoretical than practical. They do not bring self-fulfilment and ambition... instead they discourage a person from working hard. We need project- related practical work that enables one to make a product that is consumable in society. We need practical activities that relate the learning experiences to the day to day needs and make one see the relevance of science subjects in society during the learning process not after.... (FGD: A girl: Akwali Girls' S.S.S; 5/10/2011)

The above excerpt reveals that the perceived relevance of the scientific process and content to everyday life experiences is a major factor in science interest and participation for girls. This is particularly critical for girls because they generally lack the science-based experiences to build upon in the class experience as compared to the boys who have an environmentally-induced advantage in maths and science in their childhood environment (Aldridge & Goldman, 2000; Jones, Howe, & Rua, 2000). The above excerpt suggests that the absence of practical and life- related experiences in the scientific processes in the schools seem to have negatively affected girls' ability to conceptualise concepts, develop their scientific potential and ambition to excel in their performance. The girls' view that the project approach model in the science

practical classes will make science interesting and meaningful to them is supported by Brown University (1996). Brown University, advocates for science practical exercises that allow girls to do a lot of exploration through the project model approach as a strategy for sustainably increasing their understanding, self-esteem and interest in science.

Some students were given science combinations because they guarantee more points for university intake regardless of their interest. This practice demotivates them from working hard, because they are being forced to study science subjects in which they are not interested. One girl explained this view in the following manner:

... someone would have found it easier to do BCG or BAG than PCB, but because the school wants you to compete for government sponsorship, you are made to study essential science subjects in your combination that guarantee high score points so you end up doing subjects in your combination that you do not love... (FGD: A girl: Akwar girls' S.S.S; 30/9/2011)

Another girl commented

...Because they gave me a science combination I am not interested in, I will just cram, cram, and cram. It is demotivating to compete with students who are doing science combinations of their interest. I don't expect excellent grades when I am just cramming stuff without understanding... (FGD: A girl: Akwali S.S.S;5/10/2011)

These excerpts reveal that when teachers disregard girls' desire to pursue science combination of their interest, some girls are discouraged from working hard in the given combination, resulting in failure to qualify for the Uganda government science-based university sponsorship. Seymour and Hewitt (1997) also found that the performance of higher-ability girls pursuing science-related

courses in high school easily declined when their interests were not promoted by teachers who regularly supported and encouraged them.

In summary, most girls (83.5%) and boys (78.5%) indicated that they were motivated to obtain good grades in science examinations by the GSBUSP, mainly because they valued qualifying for university government sponsorship as an opportunity for being recognised as successful students in the final A-level science examinations, accessing free university education and relieving parents from the burden of paying university dues. Though most girls (83.5%) and boys (78.5%) indicated that they were motivated to obtain good grades in science examinations by the GSBUSP, there was no significant relationship between both genders' awareness of the policy and their performance in science at A-level. The boys' awareness and performance relationship was not significant at 0.573, while the girls' was not significant at 0.590. With regard to girls, one major reason for this was that the policy offered limited slots that many of them thought were beyond their capabilities to benefit from. For example 3,000 slots are offered for 150,000 both boys and girls to compete for at A-level each academic year. This number of slots is seen to be too small for both girls and boys at the same level without gendering it. Some girls, therefore, chose to work hard apparently because they felt it was the right thing to do rather than because they focused on benefiting from the policy. In addition, the policy influenced teachers to impose science combinations on girls that guarantee more points for university intake regardless of their interest. This practice de-motivated the girls from working hard because they

were being forced to study science subjects in which they were not interested. Furthermore, the absence of practical and life- related experiences in the scientific processes in the schools negatively affected girls' ability to conceptualise concepts, develop their scientific potential and ambition to excel in their performance. Both girls and boys from high socio-economic status backgrounds did not value the fees waiver benefits of the GSBUSP because their parents could easily afford university education fees. These girls and boys were, therefore, mainly motivated to obtain good grades in sciences at A-level by other factors rather than the monetary benefits of the policy.

Based on the above presentation in chapter four, it is evident that some hypotheses were accepted, while others were rejected. The hypotheses that were rejected include: Ho1, Ho2, Ho3, Ho4, Ho5, Ho6, Ho7, Ho8, Ho9, Ho10, while those that were accepted include: Ho11, and Ho12. It is from the accepted and rejected hypothesis that the summary, conclusion and recommendations of the study findings are developed in the next chapter.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSIONS AND RECOMMENDATIONS**

#### **5.1 Introduction**

This study sought to establish the impact of the Uganda Government Science-Based University Sponsorship Policy (Uganda GSBUSP) on girls' participation in the sciences at A-level as compared to boys. The researcher worked on the assumption that awareness of the fee waivers entailed within the policy influences even girls with minimal interest in the sciences to study them at A-level. This implies that girls would participate in the sciences as a means of becoming beneficiaries of the fee waivers entailed within the Uganda GSBUSP. In this context, the choice to do the sciences is influenced by the utility value consideration. In her Subject-Task Value theory, Eccles (2005) defines utility value in reference to how the importance attached to doing a task as a means for attaining some other short or long term goal influences the individual's choice to do it. Thus, this chapter presents the summary of the study findings, conclusions and recommendations generated from the study. Finally, the chapter provides suggestions for further research that other scholars may choose to focus on in related studies.

The summary and conclusion sections in this chapter are based on the results of the following 12 null hypotheses that were tested in Chapter Four. Nine of these hypotheses were rejected while only three were confirmed as shown below:

The following hypotheses were rejected:

- Ho1 There is no significant difference between girls' enrolment for the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance.*
- Ho2 There is no significant difference between boys' enrolment in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance.*
- Ho3 There is no significant difference between girls' and boy's enrolment in the sciences at A-level before the inception of the Uganda GSBUSP at .05 level of significance*
- Ho4 There is no significant difference between girls' and boy's enrolment in the sciences at A-level after the inception of the Uganda GSBUSP .05 level of significance*
- Ho5 There is no significant relationship between boys' awareness of the Uganda GSBUSP and their choice to enrol for the sciences at A-level at .05 level of significance*
- Ho7 There is no significant difference in the mean numbers of girls who performed well in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance*
- Ho8 There is no significant difference in the mean number of boys who performed well in the sciences at A-level before and after the inception of the Uganda GSBUSP at .05 level of significance*

*Ho9 There is no significant difference between the mean numbers of girls who performed well in the sciences at A-level before the inception of the Uganda GSBUSP compared to that of the boy's at .05 level of significance*

*Ho10 There is no significant difference between the mean numbers of girls who performed well in the sciences at A-level after the inception of the Uganda GSBUSP compared to that of the boy's at .05 level of significance*

The accepted hypotheses in this study include:

*Ho6 There is no significant relationship between girls' awareness of the Uganda GSBUSP and their choice of the sciences at A-level at .05 level of significance*

*Ho11 There is no significant relationship between girls' awareness of the Uganda GSBUSP and their performance in the sciences at A-level at .05 level of significance*

*Ho12 There is no significant relationship between boys' awareness of the Uganda GSBUSP and their performance in the sciences at A-level at .05 level of significance*

## **5.2 Summary of the Study Findings**

The following is a summary of the study findings presented in line with the specific research objectives.

### ***5.2.1 Comparison of girls' and boys' enrolment in science at A-level before and after the introduction of the Uganda GSBUS policy***

The study findings revealed that in the years before the inception of the Uganda GSBUSP, the average enrolment of the boys in the sciences at A-level was significantly more (61.6%) than that of girls (48.4%) by 13.2%. However, after the inception of the policy, the enrolment of both girls and boys in the sciences at A-level increased significantly. These results suggest that the new policy may have led to the increase in girls' and boys' enrolment in the sciences. The girls' enrolment increased from 48.4% to 55.4% while that of the boys increased from 61.6% to 63.6%. However, the girls' enrolment remained significantly lower than that of the boys by 8.2%. The results of the hypothesis revealed a significant difference in enrolment between girls and boys in favour of boys both before and after the policy's inception. These results indicate that the introduction of the policy may have influenced more boys to enrol for the sciences than the girls. Different reasons related to girls' persistent lower enrolment in A-level sciences, particularly with reference to the years after the inception of the Uganda GSBUSP, were established. These reasons were both school and non-school based in nature. These included:

- The deep-seated gender stereotyped belief that science is a male domain. This was the basis upon which science subjects were deliberately excluded from the girls' curriculum at the inception of formal education in Uganda. The aim of girls' education then, was to produce a girl accomplished in all ways for the requirements of a housewife. Thus, girls' low enrolment in the sciences is partly

explained by deep-seated gender stereotype belief that science is a male domain.

- The dominant presence of boys in science classes with very few women science teachers as role models discouraged girls from choosing science options. The low numbers of female science role models in secondary schools also confirms the earlier deep rooted gender stereotype that associates boys, but not girls with the sciences at A-level.
- There is also the general high attrition rate of girls from school compared to the boys as they move up in the education system due to various factors. These include parents' unwillingness to send girls to school due to cultural beliefs that portray educated girls as uncontrollable, parental poverty status, early pregnancy and marriage.
- The use of gender insensitive teaching methods in many science lessons by teachers in the O-level classes discouraged some girls from enrolling for the sciences at A-level. These unfriendly methods make girls to get lower scores in the sciences. The low scores make girls get discouraged, intimidated and hence lose self-confidence, thus, making them opt out of Sciences.

A comparison of the students' enrolment trends in the two policy eras reveals that in the era after the inception of the policy girls experienced a higher drop in their rate of enrolment compared to the boys. Girls' experienced a decrease in their enrolment rates of 7% from 68% in 2007 to 61% in 2011 compared to

the increase that they experienced in the pre-policy era of 12% from 44% in 1999 to 56% in 2003. The boys' enrolment trend however decreased in both eras of the policy. It decreased by 1% in the pre-policy era (from 62% in 1999 to 61% in 2003) and by 7% in the period after the inception of the policy (from 68% in 2007 to 61% in 2011). These results indicate that girls experienced a higher drop in their rate of enrolment after the introduction of the policy as compared to the boys. Two factors were identified as possible reasons for the decline in the girls' enrolment.

First was the high failure rate of girls in the senior five promotional examinations. Due to the relaxed recruitment criterion adopted by the schools so as to have more of their students benefiting from the Uganda GSBUSP, the relaxed recruitment policy adopted by the schools resulted into an increased number of girls with weak grades being admitted for sciences at A-level yet they could not pass promotional examinations. Such girls dropped out or repeated senior five since they were ineligible for promotion to Senior Six in the subsequent years.

The second factor was the sudden hiking of entry scores as a pre-requisite for admitting students into sciences at A-level. These stringent recruitment conditions and performance rules led to a decrease in girls' enrolment in sciences at A-level in the years following the policy inception since some of them could not fulfil all the enrolment conditions.

### ***5.2.2 Girls' and boys' awareness of the Uganda GSBUSP and their choice to enrol for sciences***

The study revealed that over three quarters of the girls (87.3%) and boys (87.1%) indicated that they were aware that government mainly sponsors science courses as compared to arts at the university. The students obtained information about the Uganda GSBUSP from different sources. Newspapers were the leading source of information for both girls (45%) and boys (58%). Besides newspapers, more girls than boys obtained information from career teachers (22%) and teachers (20%) as compared to only 12% and 8% of the boys. However, more boys (11%) obtained information from parents as compared to only 4% of the girls. School notice boards and radios that would be assumed as most accessible to students were the least identified sources of information for both genders.

The study established that more boys (63.8%) than girls (45%) indicated that they were motivated to study sciences at A-level by reasons associated with the fee waiver benefits entailed in the Uganda GSBUSP. Girls and boys who were influenced to enrol for sciences at A-level by the policy mainly did it as a means to access the benefit of the waiver of university tuition fees entailed in the Uganda GSBUSP package.

A Correlation analysis was used to establish the extent to which girls' and boys' awareness of the policy influenced them to enrol for sciences at A-level. A comparison of girls' correlation result with that of boys revealed that the girls' correlation was negatively weak and not statistically significant ( $r = -$

0.03;  $p = 0.78$ ), while that of the boys was negatively weak and statistically significant ( $r = - 0.224$ ;  $p = 0.046$ ). In this context therefore, the policy's influence on students' enrolment for sciences at A-level favours boys and not the girls.

However, the weak and significant correlation in the boys' case implies that the noticeable influence of the desire to benefit from the fee waivers entailed within policy on boys' decision to enrol for sciences at A-level was weak as signified by the correlation coefficient of determinism of 0.5. This result suggests that the influence of the boys' awareness of the fees waiver entailed in the policy contributed only 5% to their motivation to enrol for sciences at A-level, while the other 95% was contributed by other factors. Therefore, other factors influence boys' choice to enrol for sciences at A-level more than that the fee waivers entailed within the Uganda GSBUSP. These results suggest that the influence of the policy on the boys' choice to enrol for sciences as a means of benefiting from the Uganda GSBUSP is weakly significant.

The main non-fee waiver reasons for boys' choice to enrol for sciences included; the employment science careers guarantee in the labour market and the ability to perform well in sciences.

Girls were not significantly motivated to enrol for sciences at A-level by the Uganda GSBUSP. The reasons for this include: girls have other gender responsive sponsorship options that are more attractive than what is being offered by the Uganda GSBUSP, for some girls and boys the policy is seen to be offering lower level benefits like meals and accommodation that A-level

students did not value as important incentives, and students coming from higher socio-economic status homes see no need to aspire to benefit from the fee waivers entailed in the Uganda GSBUSP since they have the assurance that their parents can afford any fees demanded at the university.

The main non-fees waiver reasons for girls' choice to enrol for sciences at A-level included; the influence of family based role models and their love for sciences.

### ***5.2.3 Comparing girls' and boys' performance in sciences before and after the Uganda GSBUSP***

The *t*-statistical test results revealed that, the mean number of girls and boys who obtained high scores (2-4 PPs) in the period after the inception of the policy was significantly more than that of the pre-policy era. The *t*-test results also revealed that significantly more boys than girls obtained 2-4PPs in sciences at A-level before and after the inception of the Uganda GSBUSP.

The reasons given for the number of girls who obtained good scores in the UACE Science examinations remaining significantly lower than that of the boys are both school and non-school based. The non-school based reasons are associated with gender stereotype roles assigned to boys and girls by the society. For example, it was established that certain roles assigned to girls limit their exposure to science-based experiences to build upon in class and their cultural upbringing restricts them from interacting freely with male teachers and students. Thus, girls miss out a lot when they keep to themselves while boys interact with ease, share information and knowledge and learn from many

other people. Also, gender stereotype beliefs allocate a masculine label to the field of sciences render boys more comfortable in science related experiments, while girls are relegated to the role of observers. In addition, the type of domestic work assigned to girls does not give them ample time to revise.

The school-based reasons why fewer girls than boys performed better in sciences included; the presence of teachers who use teaching methods that are insensitive to girls' needs in class. The gender insensitive teaching methods that are practiced by some teachers in the schools make science concepts to remain abstract and this reinforces the fallacy among students, especially the girls that sciences are hard. It was also found that inadequate facilities and science equipment prohibits many girls from participating actively in science lessons as boys monopolise the instructional materials. Furthermore, some male teachers and boys discouraged girls' ambition to excel in the sciences through the use of discouraging utterances.

#### ***5.2.4 Students' awareness of the Uganda GSBUSP and their performance in science***

Over three quarters of the boys (91.2%) and girls (83.5%) indicated that they were motivated to perform better in the sciences by the Uganda GSBUSP. The extent to which the girls' and boys' awareness of the Uganda GSBUSP motivated them to obtain good grades in science examinations was verified through a correlation test.

The correlation test results revealed a positive weak but not significant correlation between both genders' awareness of the policy and their

performance in the science at A-level with  $r = 0.06$ ;  $p = .590$  for girls and  $r = 0.06$ ;  $p = 0.573$  for boys. These results indicate that awareness of the policy does not significantly influence both the girls' and boys' performance in the sciences at A-level. The positive weak but not significant correlation results mean that even the available prospect that awareness of the policy influences girls' and boys' performance in science at A-level is negligible. Therefore, it is other factors that influence girls' and boys' performance in the sciences at A-level. In this context therefore, awareness of the policy has no utility value influence on girls' performance in science at A-level.

The study established some reasons why awareness of the Uganda GSBUSP did not significantly influence girls' performance in the sciences at A-level. One major reason was that the policy offered limited slots that are not gender aggregated, thus many girls thought the few slots were beyond their reach. The girls, therefore, chose to work hard, apparently because they felt it was the right thing to do, rather than because they focused on benefiting from the policy. In addition, the policy influenced teachers to impose science combinations that guarantee more points for university intake on girls regardless of their interest. This practice de-motivated the girls from working hard because they were being forced to study science subjects in which they were not interested.

It was also established that some girls and boys were mainly motivated to obtain good grades in the sciences at A-level by factors other than the fee waiver benefits entailed in the policy. For example, some girls and boys

worked hard to obtain good grades in UACE Science examinations in order to bring pride (or to earn a name) for the school as an academically excelling school, or as a measure of 'good performance' by the students interested in prestigious labels.

### **5.3 Conclusions**

The study has resulted into six conclusions as follows:

First, the policy has not helped to eliminate the gender gap in students' participation in the sciences at A-level as expected. Significantly more boys than girls continue to enroll and perform better in the sciences at A-level even after the inception of the policy. This implies that fewer girls will continue to be admitted for sciences in the public universities on government sponsorship. Thus the intention of government to create a critical mass of women scientists in the country that is at par with the men remains a challenge even after the policy inception.

Secondly, traditional factors continue to prevent girls from attaining in scientific knowledge, skills and attitude at a par with the boys. This means that the ability of the government science-based university sponsorship per se is inadequate to address the non-fees related factors that inhibit girls' participation in the sciences at a par with the boys.

Thirdly, it was only with the boys where awareness of the Uganda GSBUSP had a significant influence on their choice to enrol for the sciences at A-level. This finding can be interpreted as the utility value reason having more influence on the boys' choice to enrol in the sciences at A-level than on the girls whose awareness of the policy did not have a significant influence on their choice to enrol for sciences at A-level. Based on this premise, it should be noted that although the policy is intended to increase students' interest and participation in the sciences equally through the offer of more science-based

university sponsorship slots, this has not been the case for the girls. Therefore, the policy is falling short of addressing the Millennium Development Goal No. 3 that focuses on equal and equitable access of education to both girls and boys by 2015. The policy does not significantly influence girls to participate in the sciences at A-level for the sake becoming beneficiaries of government university sponsorship. This means that the policy's sponsorship package is not attractive enough to arouse girls' interest to participate in the sciences for utility and cost value reasons.

Fourthly, girls' motivation to enrol and perform better in the sciences at A-level was not significantly influenced by the desire to become beneficiaries of the fee waivers entailed within the GSBUSP due to two main reasons. These reasons include; the irrelevancy of the fee waiver benefits entailed in the policy to girls from high and middle socio-economic status backgrounds and the lack of segregated slots for girls and boys in the Uganda government science-based university sponsorship. This finding means that fees waivers per se are not what girls from well to do home backgrounds need in order to attain in scientific knowledge, skills and attitude. Girls from high socio-economic status backgrounds do not value the fees waiver benefits of the GSBUSP because their parents could easily afford university education fees. Girls in this study more than boys preferred alternative pro-female sponsorship sources for university education than the gender un-discriminated government science-based university sponsorship slots.

Fifthly, it is non-sponsorship related factors that are mainly motivating girls' choice to participate in the sciences at A-level.

Sixthly, it is mainly girls from low socio-economic status homes that were motivated to enroll and perform better in the sciences at A-level for the utility reason of becoming beneficiaries of the government science-based university sponsorship. However, girls in the FGDs were quick to observe that most of the poor girls study in poorly facilitated schools which do not guarantee attainment of the good grades required for one to qualify for government university sponsorship. This means that in addition to government university sponsorship, girls in poorly facilitated schools also need to be encouraged to study sciences through a science- based sponsorship policy package that aims at equipping scientifically disadvantaged schools with science equipment, laboratories, teachers and materials.

#### **5.4 Recommendations**

The main findings of this study as specified in the conclusions have informed the following set of recommendations:

##### **The Ministry of Education and Sports**

1. The Ministry of Education and Sports (MoES) should revise the components entailed in the Uganda GSBUSP with a view to ensuring that the sponsorship attracts girls and positively influences their decision to enrol for the sciences. Such revisions should focus on allocating specific slots of the sponsorship to girls, especially those from the low socio-economic status background; broadening the policy

components to include sponsoring advocacy campaign activities such as science clinics, workshops, expeditions and exhibitions; sponsoring bridging courses for the unsuccessful university borderline girl entrants who wish to better their grades so as to qualify for university science courses and sponsoring mentoring sessions for girls who need additional support in their study of the sciences at the university.

2. MoES should enhance the recruitment of female science teachers in secondary schools by setting targets for their recruitment in these institutions. Additionally, the ministry should mandate and encourage female science teachers in secondary schools to mentor and encourage girls to opt for the sciences. The Ministry should also encourage schools to invite female scientists to offer guidance and counselling to the girls, parents, and teachers on career days.
3. The Ministry of Education and Sports should continue sensitizing different stakeholders on the need to encourage both girls and boys to equally participate in the sciences. This can be done through increasing support to the existing channels that are being used for public sensitization about the importance of girls' education in science.
4. The Ministry should formulate deliberately designed by-laws that would make it illegal for teachers, male students, and parents to indulge in practices that are meant to discourage girls from participating in the science subjects.
5. The MoES should initiate and implement a policy that mandates the Directorate of Education Standards (DES) and District Inspectors of

Schools (DISs) to emphasise the promotion of “**girl friendly schools**” that empower girls to perform better in the sciences by rewarding performers and sanctioning penalties on defaulters.

6. MoES should encourage public universities to institute remedial courses for unsuccessful A-level borderline girl entrants who wish to better their grades so as to qualify for recruitment into the competitive science courses in universities.

### **Head teachers**

1. It is recommended that head teachers relax stringent admission procedures such as the exclusive use of high O-level national exam scores for recruiting students to study the sciences at A-level. This gesture will encourage O-level girls who have interest in science to enrol for the sciences at A-level.
2. Head-teachers should make provisions for extra tuition for girls who enter the science field on a slightly weaker footing, or find themselves performing poorly. This is in an effort to provide them with extra support to retain them in the sciences while ensuring quality performance.
3. Head teachers should make more effort to recruit A-level female science teachers to serve as role models. They should also invite female scientists on school careers days to encourage girls to study the sciences.

4. Head teachers should acknowledge and reward teachers who encourage girls' participation in the sciences as another school-based strategy for promoting girls' participation in science.

### **Teachers**

1. In order to make teachers more responsive to gender dynamics in their classes, this study recommends that teachers be capacitated by teacher training institutions and through professional development workshops with skills and knowledge on how to make their classrooms gender sensitive. This might be done through using appropriate instructional methodologies and teaching-learning resources in all lessons, especially in science lessons. For instance, teachers should equitably distribute tasks to both genders and ensure that girls and boys equally participate in all learning activities in science lessons.

### **Parents**

1. Parents need to be empowered and encouraged by career teachers and school managers to share information about the Uganda GSBUSP with their daughters during the decision making process of their daughters' career choices. This is because parents have a bigger stake in the child's career choice.
2. Schools should continue encouraging parents to provide their daughters with the relevant material and non-material support that they require for learning sciences effectively so as to enable them compete favourably with boys for the competitive STM courses.

## 5.5 Further Research

1. This study was limited to two districts and to the high profile A-level government secondary schools within central Uganda. These districts and schools have different socio-economic environments from the rest of the country. This means that generalisation of these findings to other regions with different settings may not be appropriate. Therefore, a statistically generalizable study, preferably at national level, needs to be done so as to highlight a bigger picture of the influence of the Uganda GSBUSP on girls' participation in the sciences at A-level.
2. The study was also anchored on girls' enrolment and their performance in science at A-level as a precursor for their participation in the sciences at the university level, compared with their male counterparts. It is, however, acknowledged that many factors are at play that influence students' choice of the sciences at A-level. Consequently, it is recommended that a study based on university students be done to establish the extent to which the Uganda GSBUSP influenced them to take science courses for their entry to university
3. Lastly, the current study investigated the impact of the Uganda GSBUSP on girls' participation in the sciences at A-level with specific reference to science students from a gender perspective. This means that the views of the A-level arts students on why they were not motivated by the policy to opt for the sciences were not captured. In this respect, a similar study that includes girls and boys studying arts subjects at A-level can serve to increase our understanding of the

impact of the Uganda GSBUS policy on girls' participation in the sciences at A-level.

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## **APPENDIXES**

### **QUESTIONNAIRE FOR 2011 S.6 SCIENCE STUDENTS IN SECONDARY SCHOOLS IN MUKONO AND WAKISO DISTRICTS**

This is a study on “the impact of Uganda Government Science-Based University Sponsorship Policy and students’ participation in the sciences at A-Level”. This information will assist in writing my PhD dissertation. Your responses will be used for academic purposes only.

Please complete the following questionnaire honestly. There is no right or wrong answer to any of the questions. An answer is “right” if it describes what you know or feel about what is being asked.

I thank you sincerely for your time and willingness to participate in this research.

#### **INFORMATION TO HELP YOU COMPLETE THE QUESTIONNAIRE:**

Please tick the answer(s) in the box with a pen  or state ... where appropriate. Please give one answer only unless otherwise indicated.

#### **SECTION ONE: IDENTIFICATION**

101. Indicate the district in which your school is located

1. Wakiso  2. Mukono

102. State your subject combination here: .....

#### **SECTION TWO: DEMOGRAPHIC CHARACTERISTICS**

201 .Sex: 1 Male.  2. Female

202. Indicate the type of school you attend

1. Girls’ school  2. Boys’ school  3. Mixed school

**SECTION THREE: SOCIO-ECONOMIC CHARACTERISTICS**

301. Indicate the Educational Qualifications of your parents/Guardian in the spaces provided

Level of Qualification	Father	Mother	Guardian	
			Male	Female
1. None				
2. Certificate				
3. Diploma				
4. Degree				
5. Master’s Degree				
6. Doctorate				
7. Others (Specify)				

302. What is your father’s occupation? If retired or deceased, please give the occupation before retirement or passing on.

- 1. Peasant farmer
- 2. Government Employee
- 3. Retail trader
- 4. Wholesale trader
- 5. Commercial farmer
- 6. Don’t know
- 7. Others.....  
(Specify).

303. What is your mother’s occupation? If retired or deceased, please give the occupation before retirement or passing on.

- 1. Peasant farmer
- 2. Government Employee
- 3. Retail trader
- 4. Wholesale trader
- 5. Commercial farmer
- 6. Don’t know
- Others (specify).....

**SECTION FOUR: STUDENTS’ AWARENESS OF THE POLICY**

401. Which of the following categories of courses receives more government sponsorship in public universities?

- 1. Arts related courses
- 2. Science related courses

402. How did you know about these courses that receive more government sponsorship?

1. School notice boards
2. Through a friend
3. Through parents
4. Through news papers
5. Through the radio
6. Through teachers
7. Through the career guidance teacher
8. Others..... (Specify)

#### **SECTION FIVE: THE POLICY AND STUDENTS' CHOICE OF SCIENCES**

501. Becoming a beneficiary of the fee waivers entailed within the Government Science Based University Sponsorship Policy is the reason why I am studying the sciences at A-level:

1. No  2. Yes

502. Becoming a beneficiary of the tuition fees that the government sponsored students in public universities are entitled to is the reason why I am studying the sciences at A-level:

1. No  2. Yes

503. Becoming a beneficiary of the free meals that the government sponsored students in public universities are entitled to is the reason why I am studying the sciences at A-level:

1. No  2. Yes

504. Becoming a beneficiary of the free accommodation that the government sponsored students in public universities are entitled to is the reason why I am studying the sciences at A-level:

1. No  2. Yes

505. Becoming a beneficiary of the faculty allowance that the government sponsored students in public universities are entitled to get is the reason why I am studying the sciences at A-level:

1. No  2. Yes

**SECTION SIX: NON-FEE WAIVER FACTORS THAT MOTIVATED STUDENTS' CHOICE TO ENROL FOR THE SCIENCES AT A-LEVEL**

Instructions: Please tick the answer which best indicates your opinion on the statements below.

	<b>I chose to study sciences at A-level because:</b>	<b>Agree</b>	<b>Disagree</b>
601.	Science careers guarantee employment in the job market.		
602.	My parents/guardians forced me to study the sciences.		
603.	I am in a single sex school which eliminates the possibility of me being intimidated for studying the sciences by students of the opposite sex		
604.	The school allows even students with weak credit passes to study the sciences at A-Level		
605.	I love sciences.		
606.	Of peer group influence.		
607.	Of the guidance I got from the careers master/mistress.		
608.	My performance in the sciences at O-level was very good.		
609.	I was motivated by a successful female/male scientist I admire.		
610.	The science-related toys and tools I used to play with during childhood increased my interest in the sciences.		
611.	The (My?) school has adequate science facilities		

**SECTION SEVEN:THE POLICY AND STUDENTS' PERFORMANCE IN THE SCIENCES AT A-LEVEL**

701. Becoming a beneficiary of the fee waivers entailed within the Government Science Based University Sponsorship Policy is the reason why I am working hard to score good grades in my A-level:

1. No  2. Yes

702. Becoming a beneficiary of the tuition fees that the government sponsored students in public universities are entitled to is the reason why I am working hard to score good grades in my A-level:

1. No  2. Yes

703. Becoming a beneficiary of the free meals that the government sponsored students in public universities are entitled to is the reason why I am working hard to score good grades in my A-level:

1. No  2. Yes

704 Becoming a beneficiary of the free accommodation that the government sponsored students in public universities are entitled to is the reason why I am working hard to score good grades in my A-level.

1. No  2. Yes

705 Becoming a beneficiary of the faculty allowance that the government sponsored students in public universities are entitled to is the reason why I am working hard to score good grades in my A-level:

1. No  2. Yes

**SECTION EIGHT: PERFORMANCE GRADES SCORED IN THE S.6 MOCK EXAMS**

901. Tick in the answer that indicates the number of principle passes you obtained in the S.6 mock examinations.

	<b>Tick</b>	<b>Performance</b>
<b>1.</b>		2 PPs and above
<b>2.</b>		1PP and below

**APPENDIX II**

**INDIVIDUAL INTERVIEW GUIDE FOR SCIENCE TEACHERS,  
CAREERS' TEACHERS, HEAD TEACHERS AND DISTRICT  
INSPECTORS OF SCHOOLS**

**Instructions:** Before interviewing, please record the following:

Date: ...../...../..... Sex of the interviewee: ..... Name of the interviewer.....

**IDENTIFICATION SECTION**

1. What is:
  - a) The name of the district your place of work is located in?
  - b) Your designation at your place of work?

**THE POLICY'S IMPLEMENTATION BY SCHOOLS**

2. In your opinion does the administration in this school/district know that the government gives more of its sponsorship to students studying science courses in public universities?

If yes, how did the school administration know about this policy?

3. In your view has this school/have schools in this district taken any measures to encourage students to compete for the science-based sponsorship that the government offers in public universities?

If yes, what has it /have they done?

**STUDENTS' AWARENESS OF THE POLICY**

4. In your view are the A-level boys/girls in this school/district aware that the government gives more sponsorship to students studying science courses in public universities?

Give reasons for your answers.

**HOW THE POLICY RELATES WITH STUDENTS' CHOICE OF THE SCIENCES AT A-LEVEL**

5. Do you think the government's policy of giving more sponsorship to students studying science courses in public universities has influenced the decision of boys/girls in this school/district to study sciences at A' level?

Give reasons for your answers

### **HOW THE POLICY RELATES WITH A-LEVEL STUDENTS' PERFORMANCE IN THE SCIENCES**

6. In your view, has the government policy of giving more of its sponsorship to students studying science courses in public universities motivated girls'/boys' in this school/district to excel in their performance in sciences at A- level.?

Give reasons for your answers.

### **COMMENTS ON THE POLICY**

8. What challenges do girls face in studying science subjects at A-level as a way of trying to compete for the government science-based sponsorship in public universities?
9. Suggest ways in which the policy can be improved in order to enable it attract girls to participate better in science subjects at A- level?

### **Interview Guide for Ministry of Education and Sports Officials**

1. Are you aware of the Uganda Government Science-Based University Sponsorship Policy (GSBUSP)? If yes, what does it involve?
2. What activities were done by the MoES to make students at the secondary school level aware of the policy?
3. How have girls and boys responded to this policy at the secondary school level?
4. What factors influence girls' and boys' responses to the policy at A-level?
5. How else can the Uganda GSBUSP be supported to increase the number of girls participating in the sciences even at A-level.

### APPENDIX III

#### INDIVIDUAL INTERVIEW GUIDE FOR PARENTS OF 2011 S.6 SCIENCE STUDENTS

**Instructions:** Before interviewing, please record the following:

Date: ...../...../..... Sex of the interviewee: ..... Name of the interviewer.....

#### IDENTIFICATION SECTION

1. a) What is the sex of your child?
- b) Name the district in which your child's A- level school is located?
- c) Name the school your child is studying

#### AWARENESS OF THE POLICY

2. Do you know that the government offers more sponsorship to students studying science courses in public universities? If yes, how did you know about this sponsorship policy?
3. Has your child's school taken any measures to encourage students to compete for the science-based sponsorship that the government offers in public universities?

If yes, what has the school done?

#### THE POLICY'S INFLUENCE ON STUDENTS' CHOICE OF THE SCIENCES AT A-LEVEL

4. Has the fact that the government gives more of its sponsorship to students studying science courses in public universities influenced your child's decision to study the sciences at A' level? Explain your answer.
5. Has the fact that the government gives more of its sponsorship to students studying science courses in public universities **influenced you to encourage** your child to study the sciences at A-level? Give reasons for you answer.

#### THE POLICY'S INFLUENCE ON A-LEVEL STUDENTS' PERFORMANCE IN THE SCIENCES

6. Is the fact that the government gives more of its sponsorship to students studying science courses in public universities the reason your child

desires to excel in his/her performance in the sciences at A-level? Explain your answer.

7. Is the fact that the government gives more of its sponsorship to science courses in public universities the reason that **motivated you to encourage** your child to excel in their performance in the sciences at A-level? Explain your answer.

### COMMENTS ON THE POLICY

8. What challenges do girls face in studying science subjects at A-level as a way of trying to compete for the government science-based sponsorship in public universities?
9. Suggest ways in which the policy can be improved in order to enable it attract girls to participate better in science subjects at A-level?

## APPENDIX IV

### INSTRUMENT IV: FGD GUIDE FOR STUDENTS FOR 2011 S.6

**Instructions:** Before interviewing, please record the following:

Date: ...../...../..... Sex of the interviewee: ..... Name of the interviewer.....

#### IDENTIFICATION

1. Instructions: Before conducting the interview Indicate:
  - a) The type of school – single or co-educational?
  - b) District in which the school is located
  - c) Sex of the students’ focus group discussion

#### AWARENESS OF THE POLICY

2. Are you aware that in public universities government gives more of its sponsorship to students studying science courses? If yes, how did you know about the government’s science-based university sponsorship?

#### HOW THE POLICY RELATES WITH STUDENTS’ CHOICE OF THE SCIENCES AT A-LEVEL

3. Please tell me if the government policy of giving more of its sponsorship to students studying science courses in public universities has influenced the decision of **boys/ girls** in this school to study the sciences at A- level? Give reasons for your answers

#### HOW THE POLICY RELATES WITH A-LEVEL STUDENTS’ DESIRE TO PERFORM WELL IN THE SCIENCES

5. Please tell me if the government’s policy of giving more of its sponsorship slots to students studying the science courses in public universities has motivated boys/ girls in your school to excel in their performance in the sciences at A’ level as? Give reasons for your answers.

#### COMMENTS ON THE POLICY

7. What challenges do girls/boys face in studying science subjects at A-level as a way of trying to compete for the government science-based sponsorship in public universities?
8. Suggest ways in which the policy can be improved in order to enable it attract girls to study and perform better in science subjects at A- level?





**APPENDIX VI: RESEARCH PERMIT (KENYATTA UNIVERSITY)**



KENYATTA UNIVERSITY  
GRADUATE SCHOOL

E-mail: [dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)

Website: [www.ku.ac.ke](http://www.ku.ac.ke)

OUR REF: E83/10566/07

P.O. Box 43844, 00100  
NAIROBI, KENYA  
Tel. 8710901 Ext. 57530

DATE: 1<sup>st</sup> November, 2013

The Permanent Secretary,  
Ministry of Higher Education, Science & Technology,  
P.O. Box 30040,  
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MS. ELIZABETH OPIT REG. NO. E83/10566/07

I write to introduce Ms. Opit who is a Postgraduate Student of this University. She is registered for Ph.D. Degree programme in the Department of Educational Foundations in the School of Education.

Ms. Opit intends to conduct research for a proposal entitled, "Impact of Uganda Government's Science-Based University Sponsorship Policy and Girls' Participation in Sciences at A- Level in Mukomo and Wakiso Districts".

Any assistance given will be highly appreciated.

Yours faithfully,

A handwritten signature in black ink, appearing to read 'Lucy N. MBAABU'.

MRS. LUCY N. MBAABU  
FOR: DEAN, GRADUATE SCHOOL

LNM/cao

**APPENDIX VII: RESEARCH PERMITS (MOES, UGANDA)**



KENYATTA UNIVERSITY  
GRADUATE SCHOOL

E-mail: [dean-graduate@ku.ac.ke](mailto:dean-graduate@ku.ac.ke)

Website: [www.ku.ac.ke](http://www.ku.ac.ke)

OUR REF: E83/10566/07

P.O. Box 43844, 00100  
NAIROBI, KENYA  
Tel. 8710901 Ext. 57530

DATE: 1<sup>st</sup> November, 2013

The Permanent Secretary,  
Ministry of Higher Education, Science & Technology,  
P.O. Box 30040,  
NAIROBI

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MS. ELIZABETH OPIT REG. NO. E83/10566/07

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Any assistance given will be highly appreciated.

Yours faithfully,

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MRS. LUCY N. MBAABU  
FOR: DEAN, GRADUATE SCHOOL

LNM/cao

### APPENDIX VIII: STATISTICAL T-TESTS ON ENROLMENT

Number of girls before and after policy inception			Number of boys before and after policy inception		
t-Test: Paired Two Sample for Means			t-Test: Paired Two Sample for Means		
	<i>Girls Science</i>	<i>Girls Science</i>		<i>Boys Science</i>	<i>Boys Science</i>
Mean	199	130	Mean	246.8	310
Variance	308	215.5	Variance	50.7	546.5
Observations	5	5	Observations	5	5
Pearson Correlation	0.723902		Pearson Correlation	0.437053	
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
Df	4		df	4	
t Stat	12.57668		t Stat	6.64932	
P(T<=t) one-tail	0.000115		P(T<=t) one-tail	0.001328	
t Critical one-tail	2.131847		t Critical one-tail	2.131847	
P(T<=t) two-tail	0.00023		P(T<=t) two-tail	0.002656	
t Critical two-tail	2.776445		t Critical two-tail	2.776445	
Number of girls and boys before policy inception			Number of girls and boys after policy inception		
t-Test: Paired Two Sample for Means			t-Test: Paired Two Sample for Means		
	<i>Girls Science</i>	<i>Boys Science</i>		<i>Girls Science</i>	<i>Boys Science</i>
Mean	130	246.8	Mean	199	310
Variance	215.5	50.7	Variance	308	546.5
Observations	5	5	Observations	5	5
Pearson Correlation	0.557273		Pearson Correlation	0.02803	
Hypothesized Mean Difference	0		Hypothesized Mean Difference	0	
Df	4		Df	4	
t Stat	21.346		t Stat	8.6075	
P(T<=t) one-tail	0.000014		P(T<=t) one-tail	0.000501	
t Critical one-tail	2.131847		t Critical one-tail	2.131847	
P(T<=t) two-tail	0.000028		P(T<=t) two-tail	0.001001	
t Critical two-tail	2.776445		t Critical two-tail	2.776445	

### APPENDIX IX: STATISTICAL T- TESTS ON PERFORMANCE

Number of girls before and after policy inception				Number of boys before and after policy inception			
t-Test: Paired Two Sample for Means				t-Test: Paired Two Sample for Means			
	<i>2-4pp (Girls)</i>	<i>2-4pp (Girls)</i>			<i>2-4pp (Boys)</i>	<i>2-4pp (Boys)</i>	
Mean	177.2	122.8		Mean	223.2	266.8	
Variance	84.7	220.7		Variance	21.2	293.2	
Observations	5	5		Observations	5	5	
Pearson Correlation	0.24904295			Pearson Correlation	0.136985		
Hypothesized Mean Difference	0			Hypothesized Mean Difference	0		
Df	4			df	4		
t Stat	7.89650715			t Stat	-5.69752		
P(T<=t) one-tail	0.00069553			P(T<=t) one-tail	0.002345		
t Critical one-tail	2.13184679			t Critical one-tail	2.131847		
P(T<=t) two-tail	0.00139107			P(T<=t) two-tail	0.004689		
t Critical two-tail	2.77644511			t Critical two-tail	2.776445		
Number of girls and boys before policy inception				Number of girls and boys after policy inception			
t-Test: Paired Two Sample for Means				t-Test: Paired Two Sample for Means			
	<i>2-4pp (Boys)</i>	<i>2-4pp (Girls)</i>			<i>2-4pp (Boys)</i>	<i>2-4pp (Girls)</i>	
Mean	223.2	122.8		Mean	266.8	177.2	
Variance	21.2	220.7		Variance	293.2	84.7	
Observations	5	5		Observations	5	5	
Pearson Correlation	0.2821553			Pearson Correlation	-0.15198		
Hypothesized Mean Difference	0			Hypothesized Mean Difference	0		
Df	4			df	4		
t Stat	15.7452669			t Stat	9.709351		
P(T<=t) one-tail	4.7526E-05			P(T<=t) one-tail	0.000315		
t Critical one-tail	2.13184679			t Critical one-tail	2.131847		
P(T<=t) two-tail	9.5052E-05			P(T<=t) two-tail	0.00063		
t Critical two-tail	2.77644511			t Critical two-tail	2.776445		

**APPENDIX X: SUMMARY OF GIRLS' AND BOYS' ENROLMENT IN  
SCIENCE AT A-LEVEL**

BEFORE POLICY INCEPTION									AFTER POLICY INCEPTION								
Year	Girls				Boys				Year	Girls				Boys			
	Science		Arts		Science		Arts			Science		Arts		Science		Arts	
	N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
1999	113	44	144	56	242	62	146	38	2007	199	60	131	40	277	68	129	32
2000	124	50	124	50	254	64	142	36	2008	181	60	120	40	328	59	230	41
2001	128	46	152	54	240	57	180	43	2009	185	53	167	47	298	67	145	33
2002	132	47	151	53	243	64	136	36	2010	205	54	177	46	335	65	180	35
2003	153	56	121	44	255	61	165	39	2011	225	52	206	48	312	61	201	39

**APPENDIX XI: SUMMARY OF GIRLS' AND BOYS' PERFORMANCE  
IN UACE SCIENCE EXAMINATIONS**

BEFORE POLICY INCEPTION									AFTER POLICY INCEPTION								
Year	Girls				Boys				Year	Girls				Boys			
	0-1 PP		2-4 PP		0-1 PP		2-4 PP			0-1 PP		2-4 PP		0-1 PP		2-4 PP	
	N	%	N	%	N	%	N	%		N	%	N	%	N	%	N	%
1999	08	7.1	104	92.9	20	8.3	222	91.7	2007	10	5.3	180	94.7	22	7.9	255	92.1
2000	06	4.8	118	95.2	26	10.2	228	89.8	2008	15	8.3	166	91.7	45	13.7	283	86.3
2001	07	5.5	121	94.5	24	10.0	216	90.0	2009	15	8.1	170	91.9	31	10.4	267	89.6
2002	06	4.5	126	95.5	19	7.8	224	92.2	2010	18	8.7	189	91.3	51	15.2	284	84.8
2003	08	5.2	145	94.8	29	11.4	226	88.6	2011	25	12.1	181	87.9	48	16.4	245	83.6

**APPENDIX XII: NON-FEE WAIVER FACTORS THAT MOTIVATED STUDENTS' CHOICE TO ENROL FOR THE SCIENCES AT A-LEVEL**

Items	I chose to study the sciences at A-level because:	Female				Male			
		agree		disagree		agree		disagree	
		f	%	f	%	f	%	f	%
601	Science career guarantee employment in the job market	46	60.5	30	39.5	70	87.5	10	12.5
602	My parents/guardians forced me to study science subjects?	1	1.3	74	98.7	2	2.7	73	97.3
603	I am in a single sex school which eliminates the possibility of me being intimidated for studying the sciences by students of the opposite sex	2	3.0	65	97.0	4	5.9	64	94.1
604	The school allows even students with weak credit passes to study the sciences at A-level	4	5.3	71	94.7	4	5.3	71	94.7
605	I love sciences	77	97.5	2	2.5	55	68.8	25	31.2
606	Of peer group influence	25	31.2	55	68.8	33	41.3	47	58.7
607	Of the guidance I got from the career masters/mistress	48	61.5	30	38.5	50	68.5	23	31.5
608	My performance in sciences at O-level was good	50	64.1	28	45.9	79	98.8	1	1.2
609	I was motivated by a successful female/male scientist I admire	71	92.2	6	7.8	50	62.5	30	37.5
610	The science related toys and tools I used to play with during childhood increased my interest in the sciences	6	7.8	71	92.2	12	16.0	63	84.0
611	The school has adequate science facilities	30	37.5	50	62.5	43	57.3	32	42.7

