Influences on female pupils’ decisions to join the junior engineers, technicians and scientists clubs in selected schools in Zambia

Hva påvirker jenters beslutning om å ta del i junior ingeniør, tekniker og forsker klubber ved utvalgte skoler i Zambia

Philosophiae doctor (Ph.D.) thesis

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ABSTRACT

A number of studies have been undertaken to establish why the participation of female pupils is low in science, mathematics and technology education. However, no studies have been done in Zambia to establish why some female pupils decide to engage in science, mathematics and technology-based extra-curricular activities such as the Junior Engineers, Technicians and Scientists (JETS) Club. The main purpose of this exploratory study was to understand what might have influenced some female pupils' decision to join JETS Club when most female pupils avoid it. The study was located in the qualitative paradigm and was conducted in the Lusaka region of Zambia, at four schools. The researcher collected qualitative data from four different schools in order to get diverse perspectives and also to deepen his understanding of the issues under investigation. The study was guided by four research questions.

The target population consisted of female pupils in grades 10 to 12, and who were in JETS Club. The sample consisted of 48 JETS Club members (12 at each of the four participating schools), selected purposively in order to reach those who were regarded to have a good knowledge and experience of the issue under study. The researcher was of the view that this sample would give him enough data for the purposes of this study. Further information was also sought from teachers who had been working with JETS clubs to get their perspectives on the issue under study. Group interviews consisting of 12 participants were used to collect data from female pupils at each school in July 2010. Interview sessions were normally held in the afternoon, when participants did not have lessons. Data from teachers was collected using individual interviews, and the interviews were recorded and transcribed. The data was sorted out into categories using both the inductive and deductive approaches of generating categories.

A number of findings emerged from this study. With respect to what influenced female pupils to decide to participate in JETS clubs, the study found that they were motivated to join the club by six factors (or *zones of influence* , namely: personal, family members, peers, club members, teachers and the media. Of these influences, personal or internal influences were the most important factors determining the female pupils' decision to participate JETS clubs. The study also found that personal influences were reinforced or supported by external influences, such as family members, peers, club members, teachers and the media..The study established that

participation in JETS Club activities had benefits for female pupils. These were acquisition of knowledge above what was normally gained during time-tabled lessons, as well as acquisition of skills and attitudes relevant to science, mathematics and technology studies. It also came to light that there were challenges experienced by female pupils participating in JETS Club activities. These included apportioning time between JETS activities and other activities, negative attitudes of some of the pupils in JETS club towards female pupils and inadequate support from JETS Club patrons. Among the factors which female pupils in JETS Club thought contributed to most female pupils avoiding to join JETS Club included the perception that JETS was a club for boys only, belief that JETS Club tasks were difficult, lack of self-confidence and non-science related aspirations.

One of the implications which emerged from this study is that it is important to deliberately encourage more female pupils to join JETS Club because participation in JETS activities is academically and socially beneficial to female pupils. Another implication arising from the findings is that activities aimed at increasing the number of female pupils participating in science and technology extra-curricular club activities should target female pupils, family members, peers, club members and teachers.

For further studies on this topic, interested researchers are advised to investigate why some brothers have negative attitudes towards their sisters' decision to participate in JETS Club activities and why patrons did not provide adequate guidance to pupils in JETS Club when they were expected to do, so as well as what influenced male pupils to join JETS Club.

DEDICATION

This thesis is dedicated to the memory of my late father Mr Bartholomew Haambokoma, who insisted that I should go to school and to my mother Mrs Theresa Haambokoma, for the encouragement she has continued to give me.

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ACRONYMS

AFCLIST	African Forum for Children's Literacy in Science and Technology
AIDS	Acquired Immuno Deficiency Syndrome
AIEMS	Action to Improve English, Mathematics and Science
BEST	Boosting Engineering, Science and Technology
CDC	Curriculum Development Centre
CREST	Creativity in Science and Technology
DYSC	Discovery Young Scientists Challenge
ECZ	Examinations Council of Zambia
FAWE	Forum for African Women Educationalist
FAWEZA	Forum for African Women Educationalists of Zambia
FEMSA	Female Education in Mathematics and Science in Africa
GDD	Gender in Development Division
GRZ	Government of Republic of Zambia
HIV	Human Immunity Virus
ILO	International Labour Organisation
IOD	Policy and Operations Evaluation Department
JETS	Junior Engineers, Technicians and Scientists
MoE	Ministry of Education
MSTVT	Ministry of Science, Technology and Vocational Training
NGO	Non-Governmental Organisation
OSSREA	Organization for Social Science Research for Eastern and Southern Africa
PAGE	Programme for the Advancement of Girls' Education
SCFG	Science Club For Girls
SMT	Science, Mathematics and Technology
SMTE	Science, Mathematics and Technology Education
STEM	Science, Technology, Engineering and Mathematics
TWOWS	Third World Organisation for Women in Science
UNICEF	United Nations International Children's Education Fund

UNIP	United National Independence Party
WHO	World Health Organisation
ZAWIST	Zambia Association for Women In Science and Technology
ZCSS	Zambia Community Schools Secretariat

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CHAPTER ONE

INTRODUCTION

1.1 Positioning Myself as a Researcher

The researcher was trained as a science teacher at the University of Zambia. After four years of study at the University, he was recruited by the Ministry of Education and sent to teach science at a government secondary school in the eastern region of Zambia that catered for both female and male pupils. At this school, the researcher offered general science to grades 8 to 10 classes who constituted junior secondary school classes. At senior secondary school level, he offered pure biology as well as human and social biology. The researcher also served as the head of the science department at the school. As a head of science, he had the overall responsibility for the teaching and learning of science at the school, as well as for science related extra-curricular activities such as the Junior Engineers, Technicians and Scientists (JETS) Club.

During his stay at that school, the researcher interacted a lot with both boys and girls who were studying science and who were in JETS Club as well as those who were not. With respect to participation in JETS Club, his observation was that the boys and girls who were in JETS Club performed better during lessons, during the end of term assessments as well as in the end of year examinations than those who were not members of the club. Female pupils in JETS Club were also talking of pursing science and technological based careers. These observations made me to start thinking that JETS Clubs could be a good avenue for engaging pupils, particularly female ones in science and technology activities, informally, as well as a better way of encouraging them to start thinking of pursuing science and technology related careers such as medicine, engineering and science teaching. This could be because of the relaxed and supportive environment under which pupils were expected to work and the real life related activities they were expected to engage in during JETS Club sessions. But, of course, at that time these were his mere imagination which had no factual basis.

After two years of teaching at that school, the researcher moved to the southern region of the country where he started teaching at a Catholic secondary school for boys only, which was located near a Catholic secondary school for girls. The researcher taught general science to junior classes and biology to senior classes at both schools, because of the shortage of science teachers at the girls' school. During his stay at the boys' school, he rose to the position of head of science department and performed similar duties which he had earlier performed at his previous school in the eastern region of Zambia. At both schools, some pupils were members of JETS Club while others were not. The differences in participation during science lessons and performance during examinations between the two groups of pupils were similar to researcher's observations at his previous school.

After teaching for some years at both schools, the researcher took time off in 1989 to do a Master's degree in science education at King's College, University of London. During this period in Britain, the issue of gender in science and technology was being widely discussed. Sometime after his return, the researcher moved to the University of Zambia to take up an appointment as lecturer in science education. He joined the Department of Mathematics and Science Education in the School of Education where he taught science education courses to third and fourth year students training to teach science in high schools. The researcher also headed this department for a period of about eight years. One thing which attracted his attention was the small number of female students who were training as science teachers while the other arts -based department had many female students training to teach arts subjects. This was an exception to the perceived general rule that males are associated with the study of science but not females.

The researcher talked to a number of female students to find out how they found themselves training as science teachers when most female students were training to teach non-science subjects. A number of them told him that when they were at secondary school, they were members of a science club called JETS, and in this club, they were given opportunity to teach other members of the club and this developed their interest in teaching science. Others said that they just liked science and that they were as good as boys in science. These females training as science teachers believed that studying science and training to teach science were not a preserve of male students only but that even females could do the same. Thus they refused to abide by the dominant gender stereotype that science teaching was for men only. Their stance corroborates with the view of the liberal feminists who consider females to have the same intellectual capacity as males to engage in scientific activities (Sinnes, 2005). Some of the female students indicated that they received encouragement from some family members and teachers to pursue science related careers as science teaching. Literature cites examples of such type of females who refused to abide with the dominant gender stereotype that science was not for females. They were able to swim against the tide because of the support and encouragement which they got from their families and teachers; their belief that they were as capable as males and ignoring stereotypical discouraging comments from other people (Harding & Apea, 1991); internal assets they had, such as hard-working, determination, high aspiration, good academic performance and competitiveness (Reddy, 2001); a family member being in science based career, ambitions for a science and technology-based occupation, interest in science and technology, a high intellectual ability and regular involvement in science club activities (Erinosho, 2001a).

During this period the researcher was at the University, he also got involved in projects such as Action to Improve English, Mathematics and Science (AIEMS), Female Education in Mathematics and Science in Africa (FEMSA) and African Forum for Children's Literacy in Science and Technology (AFCLIST), which were promoting the participation of female pupils in science, mathematics and technology. His interest to promote participation of females in Zambia to become teachers of science made him to carry out a study in 1999, funded by the Organisation for Social Science Research for Eastern and Southern Africa (OSSREA) under the gender category. In this study, the researcher investigated what discouraged Zambian female pupils from training as science (biology, chemistry & physics) teachers. Participants in this study reported that they did not choose to train as science teachers for several reasons, some of which were: discouraging comments from science teachers and the way they taught the science subjects; presence of mathematics (which they were not good at) in the teacher education programme at university level; type of subjects they studied at senior secondary school level which were not required for training as a science teacher at college and university; poor performance in science subjects at the end of secondary school education and difficulties they experienced in learning science subjects at secondary school levels. Other reasons they gave include low numbers of female science teachers in secondary schools, giving an impression that science teaching was only for males; discouragement from parents and relatives, and no added advantage over non-science teachers in terms of remuneration (Haambokoma, 2002).

In 2008, the researcher decided to participate in a project known as 'Project SUSTAIN'. This project was initiated by two female science teacher educators (one) at the Norwegian University of Life Sciences in Norway and (the other one) at University of Kwa-Zulu Natal in South Africa. Project SUSTAIN was informed by the works of Professor Kyle. Kyle's (2006) view point has been that science and technology education should motive pupils and students to use their knowledge, skills and attitudes to transform the world so that it is more sustainable. He is of the view that this could be done by addressing global challenges such as poverty, health, gender equality, climate change and access to clean water (Kyle, 2006; Sinnes, Kyle & Alant, 2010).

Before the Project came into being, the researcher interacted with the two science teacher educators as well as with Professor Bill Kyle during AFCLIST workshops and The Southern Africa Association for Research in Mathematics, Science and Technology Education (SAARMSTE) conferences. Project SUSTAIN drew researchers and students from University of Kwa-Zulu Natal and University of Pretoria in South Africa, Chancellor College in Malawi as well as The University of Zambia. In Norway, researchers came from the University of Life Sciences and Oslo University. The two female science teacher educators put into practice a commonly articulated statement *'if you educate a female, you educate the whole community.'* Project SUSTAIN had two major goals, namely to encourage research on issues related to how more pupils, in particular females, could gain more access into science and technology education. Secondly, it sought to explore new means of making science and technology education more relevant and socially responsible to students with different backgrounds and interests (Sinnes, Kyle & Alant, 2010). The Project supported research at both Master's and PhD levels as a way of building capacities.

Therefore, when an opportunity arose for him to do doctoral research under Project SUSTAIN, he thought that investigating factors that make some female pupils decide to join the Junior Engineers, Technicians and Scientist (JETS) Club was appropriate. This is because in Zambia most female pupils avoid participating in science and technology- based activities such as JETS Club (Haambokoma, 2010) and yet it is important for female pupils to be involved in such activities. Thus, this study was mainly about understanding female pupils who could be said to '*swim against the tide'*. Research in education has in most cases concentrated on investigating challenges rather than on successes female pupils score. As Reddy (2001: 36) states "it seems difficult, even awkward to find goodness and talk about success." Indeed most research in science education has presented female pupils as having a negative attitude towards science, technology, engineering and mathematics (STEM).

1.2. Background and context of the study

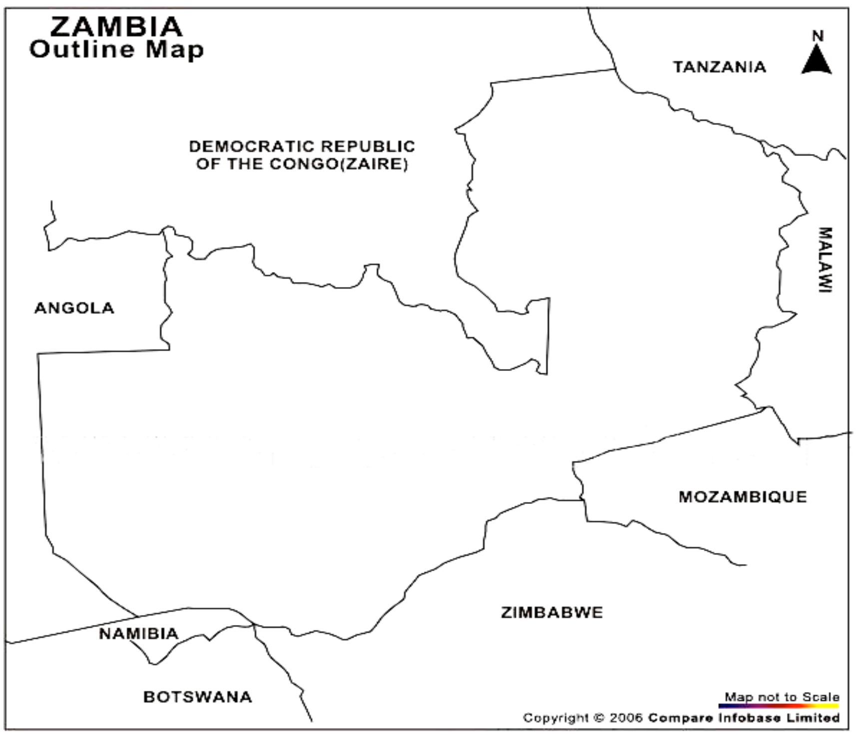
The study was conducted in Zambia, a country on the African continent. The name 'Zambia' is derived from the river Zambezi. Zambia is a sub-Saharan land-locked country, located in the Central-southern region of Africa. Zambia lies between latitudes 8 degrees and 18 degrees south and longitudes 22 degrees and 34 degrees east. Figure 1 shows the geographical position of Zambia on the African continent.

Figure 1: Geographical position of Zambia in Africa

Source: GraphicMaps.com

Zambia has a total area of 752 614 square kilometres (roughly about the size of France, Switzerland, Austria and Hungary put together). It has a maximum width of 1 206 kilometres (East-West) and a maximum length of 815 kilometres (North-South). It is surrounded by eight countries as follows; Angola in the west, Democratic Republic of Congo in the north-west; Tanzania in the north-east; Malawi in the east; Mozambique in the south-east; Zimbabwe, Botswana and Namibia in the south. Figure 2 shows Zambia's neighbours.

Figure 2: Zambia and its neighbours



What is known as Zambia today was a British protectorate called Northern Rhodesia from 1924 up to 1953, which then became part of the Federation of Rhodesia and Nyasaland from 1953 to 1963 (Carmody, 2004). On 24th October 1964, Zambia attained its independence from Britain and became The Republic of Zambia.

According to the national census conducted in 2000, the total population in Zambia was 10.2 million (GRZ, 2001), and 50.7% of that population were women (MoE, 2002). This means that there were slightly more females than males in the Zambian population at that time. The majority (about 60%) of the population lived in rural areas while about 40% lived in urban areas. However, preliminary results of the most recent census conducted in 2010, released on 27th January 2011, suggests that the Zambian population has increased to just above 13 million people, comprising 49% males and 51% females (Central Statistical Office, 2011).

The Zambian population consists of 73 ethnic groups. The official language used in government offices and the language of instruction in schools, particularly from grade 5 upwards in government schools is English, meaning that teaching and learning materials in most subjects are in the English language (MoE, 1996). However, the use of English as the medium of instruction in schools has been criticised (see e.g., Kelly, 1995; Siluyele, 1996; Kelly, Msango & Subulwa, 1999; Maimbolwa-Sinyangwe & Chilangwa, 1995). Generally, it has been argued that English makes it difficult for pupils to learn. Maimbolwa-Sinyangwe and Chilangwa (1995) found that the use of English affected girls negatively, much more than boys because girls did not like to be laughed at if they made mistakes. The use of English in instructions has also arguably contributed to some female pupils dropping out of school because they found it more difficult to learn and speak English (Kelly, Msango & Subulwa, 1999) than boys. The assumption we can make here is that learning of any language depends on how much practice one has in that language. If many girls feel shy to participate in the language because they fear to be laughed at when they make mistakes during oral practice, they may reduce their participation in language activities in class. This could be one possible reason for their poor performance. This assumption may find support when we consider the performance of girls in single sex schools where they do better than boys and this is not just in English language but even in other subjects. It is not clear whether or not female pupils who join and participate in extra-curricular activities such as JETS Club improve their self-expression in English or communication skills.

Although the use of English for teaching has not been supported by certain sections of society, it also has advantages in that most learning materials we need in Zambia from outside Zambia are written in English. Furthermore, use of English unites learners from various parts of the country and also prepares them to be able to communicate with different kinds of people within and outside the country. Zambia has seven main local languages taught in schools, namely, Bemba, Kaonde, Lozi, Lunda, Luvale, Nyanja and Tonga. These languages have been taught in regions where they are dominant and are used as the *lingua fracas* in these regions. These are the same languages used for initial literacy for children. This was in line with government policy which demanded that pupils be given an opportunity to learn initial fundamental skills of reading and writing in a local language first and later transfer the skills to the learning of initial literacy in English when they move to grade two (MoE, 1996).

Administratively, Zambia was for a long time divided into nine provinces namely Central, Copper belt, Eastern, Luapula, Lusaka, Northern, North-western, Southern and Western. However, recently, a new province was created known as Muchinga bringing the number of provinces to ten. Muchinga province was part of Northern and Eastern provinces. Figure 3 shows the distribution of Zambia's nine provinces. Muchinga province does not appear on this map.

Figure 3: Distribution of Zambia's Provinces

Source: http://www.google.com/images

Each province is further divided into districts. The number of districts vary from province to province. Each province has its own headquarters, and none of the provinces is self-governing. Lusaka is the administrative, legislative, judicial and commercial capital of Zambia. It is located in the south-central part of the country (see Figure 3) with all government ministries and most major companies being headquartered there. The University of Zambia is also located in Lusaka as well as non-governmental organisations spearheading gender equality. As a result mostly female pupils in urban areas are encouraged to challenge gender stereotype with respect to science and technology in comparison to female pupils in rural areas. The present study investigated how some female pupils challenge gender stereotype with respect to JETS Club.

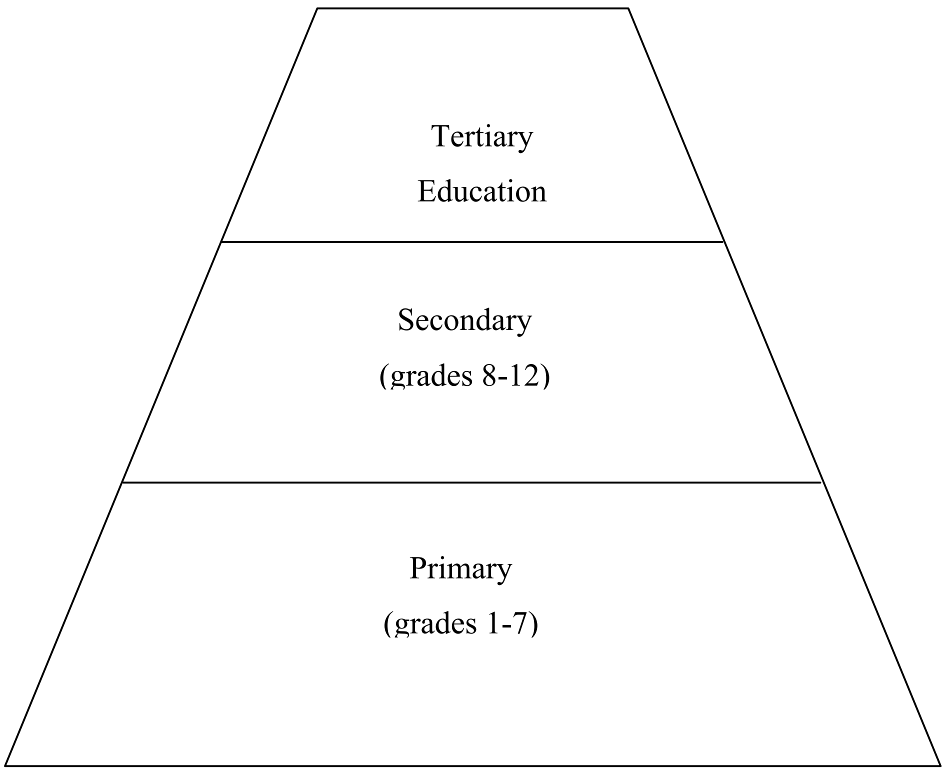
1.2.1 The Zambian Education System

The Ministry of Education is the main provider of education at nearly all levels of the Zambian education system (MoE, 1996); a ministry that is the largest and most widely spread in the country (MoE, 2001a; 2002). For purposes of educational administration, the country is divided into educational regions which correspond with provinces. Each region is further sub-divided into districts and each district has a number of different kinds of schools offering primary and secondary education. Some of these schools are single-sex, co-education (i.e., caters for both male and female pupils) and day-schools, these being schools without boarding facilities. Among these schools, some are mission schools run by church organisations but receiving support from government while others are government-run by the Ministry of Education.

In addition to government and grant-aided schools, a number of private schools, located mainly in urban areas, have emerged since 1991. Recently, a number of community schools supported and run by communities as well as non-governmental organizations have been established because of the inability of some families to pay school fees and other related costs levied on pupils in other types of schools. Community schools also cater for children who have never attended public schools and are over the school-going age. When admitting children into community schools, preference is normally given to girls and orphans (ZCSS, 1998).

With the change of government in 2011, there has been a shift from basic (grades 1-9) and high schools (grades 10-12) to primary (grades 1-7) and secondary schools (grades 8-12) schools. In the current study, the participants were drawn from grades 10 -12. Figure 4 shows a diagrammatic representation of Zambia's education system.

Figure 4: Structure of the Zambian Education System



As Figure 4 shows, from secondary education you go to tertiary education whose duration varies from 2 to 7 years. Tertiary education comprises training at universities, colleges of commerce, nursing schools, technical colleges, colleges of education, agricultural colleges and skills training institutes. Good examination grades in sciences and mathematics are required for both female and male applicants to enter most of these study programmes. It is not clear if at all the type of training programmes some female pupils intend to pursue after their secondary education have influence on their decision to join JETS Club. The present study would like to establish whether or not this is the case. At nearly all levels of the education structure given above, various studies (e.g. Kelly, 1994; MOE, 2007) have revealed that girls are the disadvantaged group and the ratios between girls and boys are not balanced. This scenario is worsened by the poor progression rate among girls. This may in turn affect the number of girls who can join clubs let alone, male-dominated clubs such as JETS. This may explain why focusing on girls in such clubs is worthy being investigated to establish their experiences as they work with boys.

1.2.2 Examinations and Progression

National examinations are held at the end of grades 7, 9 and 12 (MoE, 1996). The results of these examinations are used for various purposes including selection and certification (MoE, 1977; 1992; 1996). School places are limited in Zambia as one moves up the educational ladder, because of this, there is selection into grades 8 and 10 as well as into colleges and universities. Pupils must score certain marks (referred to as cut-off point) to proceed to the next level, that is, from grade 7 to 8, grade 9 to 10 and from grade 12 to institutions of higher learning. The cut-off points (i.e., qualifying mark or pass mark) are not determined in an arbitrarily manner, instead, they are determined by the number of places available and the general performance of candidates in the examination in that particular year. For example, if the number of places available in grade 10 are few and the performance of pupils in the grade 9 examination is good, then the cut-off point/pass mark goes up. At each level, the cut-off point/pass mark varies from year to year and from region to region as well as between boys and girls. It also varies from one school type to another within a region. The Cut-off point for boarding schools is higher than that for day schools. Similarly, some mission schools considered to be good schools have higher cut-off point than those for some government schools.

In Zambia, performance of female pupils in these national examinations has been generally lower than that of male pupils particularly in mathematics, technical and science subjects (Mwase *et al.,* 1999). This pattern has also been reported in other African countries such as Cameroon, Ghana, Tanzania and Uganda (FEMSA, Dissemination Report No. 5, n.d.). The current study will investigate whether or not the desire to improve performance in national examinations in science subjects could be one reason why some female pupils join JETS Club.

Since the 1970s, the cut-off point for progression from grade 7 to grade 8 and from grade 9 to grade 10 for female pupils is lower than that of male pupils (Kasonde-Ng'andu *et al.,* 2008). The reasoning behind this is that unlike male pupils, female pupils are overloaded with household chores (Mwase *et al.,* 1999; Munjanja *et al*., 1996) which might affect their studies and cause them to do poorly in national examinations. Therefore, they should be compensated for this by lowering their pass mark (Mutukwa *et al*., 1995). This is a good arrangement as it has enabled a number of girls to proceed further in education. This is particularly good for a number of female pupils who are not in boarding schools in that they are disadvantaged compared to male pupils because they are not given time to study at home owing to domestic work they are expected to do upon return from school (Kelly, Msango & Subulwa, 1999).

However, some educators do not support this affirmative action arguing that it discourages female pupils from working hard and also lowers their self-esteem (Mutukwa *et al.,* 1995; Kelly *et al.,* 1999). They assert that girls start believing that they are less capable than male pupils, a perception which has been reported by some scholars elsewhere (Mfou, Quaisie, Masanja & Mulemwa, n.d.). Kelly *et al.,* (1999) also point out that teachers and society at large perceive this to mean that girls are not as able as boys intellectually. At the University of Zambia, the cut-off point for admission for female students has also been lower than that of male students. For example, in the 2009 academic year, the cut-off points for admission into the Bachelor of Science with Education degree programme were 15 points for males and 28 points for females. In the 2010 academic year, the cut-off points for the same programme were 11 points for males and 15 points for females (Academic Office, 2009; Academic Office, 2010). This could be one reason why some female pupils do not bother to join JETS Club in that their cut-off point is lower than that of male pupils. That is, they do not need to get as high marks as boys in order to be admitted into various programmes at the University of Zambia. However, this arrangement does not apply to assessment during their studies. This is because the grading system for every course is the same for both female and male students.

Competition becomes stiff as one moves up the educational ladder because of the pyramidical nature of the educational system (see Figure. 4). There are more primary schools than secondary schools and more secondary schools than colleges and universities (MoE, 1996). Furthermore, the progression rate (based on the number of pupils who are selected to the next level of the education system compared with those who sat the examination) reduces as one moves up the educational ladder from one level to another. For instance, in 2001, the progression rate from grade 7 to grade 8 was 48.6% while that from grade 9 to 10 was 25. 9% (MoE, 2002). However, in recent years, there has been an improvement in progression rates owing to construction of more schools. For example, in 2007, about 54.5% of pupils who sat the grade 7 leaving examination proceeded to grade eight. In the same year, 38.7% of the pupils who wrote the grade 9 examination proceeded to grade 10 (MoE, 2007). In both 2001 and 2007, the progression rate for female pupils was slightly higher than that of male pupils (MoE, 2002;2007). However, this does not mean that more girls than boys proceeded to the next level of the education system. What this means about my sample in the current study is that it is mainly made up of high achieving girls who have been passing examinations at different levels of the Zambian school system.

1.2.3 Formal Education for Girls in Zambia

Formal education for girls was introduced in Northern Rhodesia around 1930 (FAWEZA, 2009). The type of education provided to female pupils at that time was meant to prepare them to be better mothers and wives (Malambo & Ntalasha, 1999). Therefore, the curriculum consisted mainly of study areas such as homecraft, cookery, needle work and mothercraft. Meanwhile, the curriculum for boys was more advanced than that of girls (FAWEZA, 2009). Malambo and Ntalasha (1999) report that unlike in the case of girls, one of the issues boys were taught was to be creative. During the pre-colonial, colonial and the federation periods, the number of girls attending school was less than that of boys (Carmody, 2004). For example by 1960, the total number of pupils attending primary schools was 28 7536 representing 62% of the boys and 45% of the girls who had reached the school-going age (Carmody, 2004).

Boys had more access to schools than girls because there were more schools for boys than for girls. This was particularly true at junior and senior secondary school levels as well as at tertiary level. Unfortunately, this situation continued for many years after independence in 1964. Various reasons could have contributed to this situation. For example, Carmody (2004) suggests that reluctance by both government and mission organisations to provide education for girls could have caused this imbalance as well as the fact that families had not much desire to see girls attend school. The progression rate for female pupils was also lower than that of male pupils. As late as 1990s, female pupils still lagged behind male pupils in completing school (Maimbolwa-Sinyangwe, 1994; Kelly, 1994; Munachonga, 1995; MoE, 1996). While this may explain why there could be fewer girls in schools to join many clubs, it may not explain, why some girls join the perceived male-dominated club such as JETS. The Ministry of Education (1996: 62) describes the situation regarding the progression of female pupils before 1996 as follows:

> For every 100 girls who begin primary school, only 70 complete the primary grades, 23 proceed to junior secondary, 9 to senior secondary and, 7 sit for the grade 12 school certificate examination. Opportunities for boys are considerably better, with 87 out of every 100 grade 1 entrants completing the primary grades, 37 enter junior secondary, 16 proceed to senior secondary and 15 for the school certificate examination.

Apart from availability of school places, there were other factors which contributed to the drop-out of female pupils such as pregnancies, early marriages and the perception by society that education for girls was a privilege which had to be earned (MoE, 1996). Others included beliefs by parents or guardians that sending a boy to school was more important and more economical to the family than sending a girl (FAWE, n.d; Munjanja *et al.,*1996). Even if there are few girls in schools, in particular at senior secondary school level, there are still some girls who join male-dominated clubs such as JETS for reasons not known.

In recent years, the Zambian society has realised that providing opportunities for more girls to attend school is one of the best investments a developing country such as Zambia can do (UNICEF, 1994; MoE, 1996). This realisation has come about as a result of various research findings from other countries which have pointed out the importance of educating girls, as well as international conferences held in various parts of the world such as the World Conference on Women held in Beijing in 1995 which focused on gender issues. The Zambian Ministry of Education has been arguing for the education of girls, using the following statement from one organisation promoting the education of girls:

> Research shows that investing in girls' education provides the highest return on any investment that developing countries make. An educated girl is more likely to become a more competent mother, a knowledgeable family planner, a more productive and better paid worker, an informed citizen, a skilful decision maker and a self-confident individual. Her potential contributions to the well-being of society and its economic development cannot be underestimated (MoE, 1998: 4).

The above quote by the Ministry of Education should not be taken to mean that the Ministry of Education is saying that educated girls are only expected to perform the roles indicated above, but that once educated, they can perform many other responsibilities to contribute to national development in areas such as agriculture, health, education just to mention a few.

In addition, it has also been recognised that education is a basic human right for girls just as it is for boys (MoE, 1996). Some advocates for educating girls have also argued that educating a girl would benefit more people than educating a boy (see for example, Mutukwa, *et al.,* 1995; Reddy, 2002). They have argued that if you educate a girl, you have educated the whole community, if you educate a boy, you have educated an individual. Females make a significant contribution to the well-being of a family and society at large. This is because they are in the forefront of production and preparation of different food types in most homes in Zambia, particularly in rural areas. They also play an important role in the area of family health, in that they take the responsibility in most cases to administer medication, especially to children and are more caring to patients within the family setting and community (Dimitriadi, 2013). They are good at sharing useful information with family members and society at large (Dimitriadi, 2013). They also tend to be good teachers at family level. They participate much more in community activities than males. Girls attach more importance to assisting other people than boys (Jenkins & Pell, 2006).

Therefore, the issue of gender differences in educational provision has started to be considered as an issue requiring to be addressed in Zambia. One of the major steps taken to address gender inequality was the launch of the National Policy on Education in 1996 called 'Educating our Future', which gave high priority to the education of girls and committed the Zambian Ministry of Education to the removal of gender differences in the education system (MoE, 1996). Following the launch of this policy, a number of things have been done by the Ministry of Education, non-governmental organisations and co-operating partners to ensure that girls receive the same quality of education as boys. Most of the Ministry of Education activities regarding gender were being done through the Programme for the Advancement of Girls' Education which in short is known as PAGE (MoE, 1998). This programme started as a pilot project in 1994 and was expanded to cover all parts of the country in 1997 (MoE, 1998). Through this programme, the Zambian Ministry of Education made efforts to improve girls' admission, retention, completion and attainment in school. With this improvement in enrolment of girls in schools, one would expect a corresponding number of girls joining extra-curricular school clubs such as JETS, but this has not been the case. This is the reason why the few who join such clubs attract attention, hence the current study which tries to establish how such girls are viewed by both the boys and the fellow girls who shun such clubs.

The Programme's interventions targeted classroom teachers, teacher educators, education managers, policy makers, members of the community, parents/guardians, boys as well as girls themselves. According to the Ministry of Education (1998), among the steps PAGE took at national level to accomplish its objectives, were: support for girls' education, production of gender neutral learning and teaching materials; and, affirmative action to increase the number of females in the leadership positions such as provincial and district education officers, standards officers, head teachers and deputy head teachers. At provincial and district levels, actions taken included educating officials on the policy of the programme, building the capacity of provinces and the districts to implement the programme's activities, support gender studies during the initial training of teachers' phase as well as during the post initial teacher training.

At school level, actions taken included creating an environment supportive of female pupils' education through sensitisation of school managers and teachers, increasing engagement of parents in the education of girls, developing self-esteem and enhancing self-confidence of girls through clubs. At community level, the steps taken included creating awareness on the importance of educating girls among parents, chiefs and village leaders. However, one may ask the extent to which these sensitisations have achieved their intended goals. Furthermore, it is not clear if the various stakeholders given above have made any efforts to encourage female pupils to join JETS Club. It was the intention of the current study to investigate this.

In addition to PAGE, the Forum for African Educationalists in Zambia (FAWEZA), a non-governmental organisation (NGO) established in 1996, has been advocating for female empowerment through education (FAWEZA, 2005). In order to achieve this, FAWEZA is doing the following: creating opportunities for increasing girls' admission into school through activities such as lobbying for more school and college places for females, and sensitising communities on the value of educating girls; building an enabling environment for girls in learning institutions through encouraging institutions to provide physical facilities that are friendly to girls and supporting clubs which improve girls' self-esteem. Others include the following: enhancing the retention of girls in education through activities such as campaigning for the implementation of the re-entry policy of 1997, which allows girls who become pregnant to take leave and come back to school after the baby is grown enough, and implementing a bursary programme for girls from poor families and unsupported orphans to enable them meet the costs of education at upper basic and high school levels; improving the learning attainment of girls in school through activities such as remedial learning camps. In this regard, FAWEZA, in collaboration with certain schools, has been conducting learning camps for girls in examination classes (i.e. grades 7, 9 and 12). The target pupils have been those who are behind academically and from poor families but have the potential to make progress in their school work (FAWEZA, 2005). The learning camps are meant to help girls so that as many female pupils as male pupils complete school and obtain good results to move on to the next level in the education system (FAWEZA, 2005). Despite all these efforts, girls' self-esteem and assertiveness are not enhanced to an extent that they can join boys-dominated clubs such as JETS. This is why this study wanted to find out how the few who dare join such clubs are treated by others and what actually motivates them to do so.

The Zambian free basic education policy of 2002 and the policy which abolished payment of grade 7 examination fees in 2003 have also assisted to increase the number of girls accessing and progressing in education (FAWEZA, 2009). Furthermore, the Ministry of Education and some religious organisations opened access to female pupils in schools, which were once for male pupils only. We can argue here that these steps were meant to assist a girl-child become self-esteemed and assertive and be able to make decisions of joining various extra-curricular clubs such as JETS. As a result of these initiatives, completion rates for female pupils at grades 7 and 9 levels improved (IOD, 2008). Enrolment at grades 10-12 level also increased (MoE, 2007).

Table 1 shows national Gross Enrolment Ratio (GER) at grades 10-12 level of the Zambian education system during the period 2006 to 2010. Female pupils who participated in this study were drawn from this level. The GER is the total enrolment of female pupils in grades 10-12 expressed as a percentage of the eligible official school-age population, corresponding to the same level of education (MoE, 2007).

Table1: National Gross Enrolment Ratio for Female pupils in Grades 10-12 by year

Year	Female population	Female pupils	Gross Enrolment Ratio (GER)
2006	390 288	85 980	22.03%
2007	402 454	99 186	24.65%
2008	415 139	106 645	25.69%
2009	427 523	112 817	26.39%
2010	439 161	123 423	28.10%
Average	**414 913**	**105 610**	**25.43%**

Source: Zambia Annual School Census

As Table 1 shows, the average national GER for the period 2006 to 2010 was 25.43%. The table also shows an increase in the GER from 2006 to 2010. Table 2 shows the GER for female pupils in grades 10-12 level during the period 2006 to 2010 for Lusaka region in which the current study was conducted.

Table2: Lusaka region Gross Enrolment Ratio for female pupils in grades 10-12 by year

Year	**Female population**	**Female pupils**	**Gross Enrolment Ratio (GER)**
2006	52, 736	15, 605	29.59%
2007	54, 483	18, 235	33.47%
2008	56, 385	19, 844	35.19%
2009	58, 193	19, 162	32.93%
2010	59, 732	22, 735	38.06%
Average	**56, 307**	**19, 116**	**33.85%**

Source: Zambia Annual School Census

Two issues emerge from the numbers and statistics given in the two tables in relation to the current study. One is that the sample of female pupils for the current study was drawn from high achieving female pupils (grades 10-12) who passed selection examinations at grades 7 and 9 levels. Another issue is that the percentage of girls in school was less than 35%, showing that they were disadvantaged. This could explain why not many female pupils in comparison to male pupils decide to join JETS Club. However even in schools where there are female pupils only, the number of pupils who join JETS Club is not that high.

1.2.4 Science and Technology Education in Zambia

It is generally recognised worldwide that scientific and technological knowledge, skills and attitudes are important for personal and national development (Aguele & Agwagah, 2007; Das, 2004; Erinosho, 2001a; Harding & Apea, 1990; Macfarlane et. al., 1990; Makhurane, 1998; Mulemwa, 2004; Wellington, 2003; Uhlig, 1999; UNESCO, 1991; O-saki & Bunwaree, 2003). In this connection, Harding and Apea (1990: 5) point out that national "survival and development is dependent on the possession and use of science and technology". Similarly, UNESCO (1991) asserts that there can be no socio-economic development without science and technology. The importance of science and technology to personal and national development has also been pointed out in reports such as those of the United Nations Conference on Science and Technology for Development (1979) and Lagos Plan of Action (1980).

Regarding personal development, UNESCO (1991) asserts that science and technology can enhance one's personal skills in logical thinking, expression, personal management, cooperation and responsible action. All these are important in a person's life. Aguele and Agwagah (2007: 121) observe that "if any nation must develop, the study of science, technology and mathematics should be given adequate attention in various levels of her education". The importance of educating citizens, including girls and women in science, technology and mathematics to bring about national development is also supported by Ukeje (1997) ; Mulemwa (1999a) and Uhlig (1999). Acquisition of appropriate scientific and technological knowledge, skills and attitudes by citizens (both females and males) would enable a country fight diseases, hence secure good health, use the environment in a more sustainable manner as well as react to climatic problems, grow more food for consumption as well as for sell to raise funds to send children to school and meet other expenses. This would also enable a country develop new industries and technology as well as improve the education system to foster more development (Ekine & Abay, n.d). These would in turn improve productivity and generate work opportunities (EGM, 2010). Countries like India are what they are now because they put an emphasis on science and technological education in their schools and created a conducive environment for it in schools (Misra, Bhushan & Upadhyay, 2013).

However, it is important to note that the link between science and technology, and national development is not direct. There are other intervening variables, and these include: availability of appropriately trained human resource (both females and males) who are able to apply scientific and technological knowledge and skills to address developmental issues; conducive work environment; commitment to work by various categories of human resource and accountability in the use of resources.

In Zambia, the belief in the importance of scientific and technological knowledge, skills and attitudes for national and personal development is well documented (Mulopo, 1986; MoE, 1996; Mwenya, 1998). In view of this, Zambia has undertaken to provide its citizens with scientific and technological education to enable them make informed decisions concerning personal and societal issues in their daily life and to generate the necessary human resource needed by the country (MoE, 1977; 1996; UNIP, 1973).

Currently in Zambian schools, integrated science is offered at the lower basic school level (grades two to four) and at grades five, six and seven level (MoE, 2000). The study area of integrated science consists of the following subjects; Environmental Science, Home Economics and Agricultural Science. It also includes issues such as Environment, Reproductive Health, HIV and AIDS, Hygiene, Nutrition, Substance abuse, Water and Sanitation (MoE, 2003), which are areas of great concern in society. By the end of grade seven, pupils are expected to have acquired scientific knowledge, skills and attitudes that should assist them to investigate and know their immediate surrounding and the world at large (MoE, 2003). To achieve this aim, teachers are encouraged to use teaching methods which provide opportunities to pupils to participate fully in the learning process. However, in reality this goal is not totally achieved partly because in most cases, teachers do not teach science using a practical approach involving pupils to engage in scientific inquiry. Furthermore, teachers teaching science at this level are not specialised science teachers who may have no interest in teaching science. Therefore, they do not put much attention to appropriate ways of teaching science. Apart from integrated science, pupils at these grade levels also take Creative and Technology studies. This is a learning area which comprises the following traditional subjects: Industrial Arts, Art and Design, Home Economics, Physical Education and Music. It is anticipated that by the end of grade seven, pupils should have developed the power of observation, attention to detail, creativity and imagination (MoE, 2003). Within this broad learning area, pupils cover technology aspects, which include design, construction and modelling (MoE, 2003).

At junior secondary school level (grades eight-nine), pupils take Environmental Science, which comprises topics from Biology, Physics and Chemistry, (CDC, 1986). Integrated Science and Environmental Science are compulsory for all pupils in the grades they are offered. In addition to learning environmental science, some pupils at this level of education (grades eight and nine) also learn other science or technology-related subjects, such as Agricultural Science, Woodwork, Technical Drawing and Metal work.

Before 2002, the Ministry of Education allowed pupils in high schools (grades 10 – 12) to take at least one science subject (i.e., agricultural science, biology, chemistry, physics or science) as part of their school curriculum. After 2002, the Ministry directed all high schools to offer their pupils any one of the following subject combinations in science; biology, chemistry and physics or agricultural science, chemistry and physics or agricultural science, biology and science or science and biology or agricultural science and science (MoE, 2002). This therefore means that since 2002, all pupils (females and males) at high school level are expected to take at least two science subjects.

In some schools, particularly in technical schools, pupils are given a chance to study woodwork, technical drawing and metalwork in order to prepare them for technical related training after grade 12. However, more boys are given chance to study these subjects than girls. In 2011, the then Zambian Republican President observed that the country needed scientific and technological skills to participate effectively in the regional groupings to which Zambia belongs and to develop. He put it as follows:

> Zambia needs more scientists, technologists and mathematicians for it to properly position itself in the region and beyond and consistently address issues regarding national development from a scientific and technological perspective (*Zambia Daily Mail, March* 9, *2011, p.1*) .

This wish is supposed to include both girls and boys becoming scientists and technologists. However, the situation in Zambian schools is that classrooms are overcrowded. This arises from over-enrolment due to inadequate schools. This makes it difficult for teachers to give individual attention to pupils who may need it, in particular, some female pupils who incorrectly think that certain subjects are difficult for them to learn, such as sciences and mathematics. In some mixed sex schools, the number of female pupils is lower than that of male pupils and this is especially in classes taking science subjects. In such situations, it is difficult for some female pupils who are shyer than male pupils to participate in the learning process for fear of negative comments from male pupils. Furthermore, the issue of HIV and AIDS in families disadvantages female pupils in that in most cases, they are asked to look after the sick which is not common for male pupils (Kelly, Msango & Subulwa, 1999).

In addition, unlike male pupils, female pupils experience early pregnancies which in one way or another affect their learning. Another issue is that at secondary school level, the number of female teachers is less than that of male teachers even in schools for girls only. This is particularly so in science, mathematics and technology subjects. All these issues make schools unfriendly for girls and reduces the self-esteem of female pupils to join clubs like JETS, dominated by male pupils and wrongly perceived to be a boys' club.

1. 2. 5 Education of female pupils in Science and Technology

Education of female pupils in Science, Mathematics and Technology (SMT) is an important tool for personal and national development (Aquele & Agwagah, 2007; Nassor, 2001). Harding and Apea (1991) further point out that not only is science and technology important for development but to females also. It can therefore be deduced that provision of science and technology education to both females and males equally can accelerate national development (Mulemwa, 1999a). Reddy (2002) asserts that there is a lot of literature pointing to the fact that investment in girls' education yields high economic and social benefits. She further argues that whether one is looking at benefits from the perspective of contributing to economic development, improved quality of life for all or from an equity and social justice point of view, there is no doubt about the need for improvement in the area of female pupil-participation in science, mathematics and technology education. However, some parents are of the view that science is not important for female pupils (Andre, Whigham, Hendrick & Chambers, 1999).

The importance of participation of females in SMT education has also been advanced by various organisations. For example, the Third World Organisation for Women in Science (TWOWS) during its Second General Assembly and International Conference held in Cape Town in 1999 stated that there could not be sustainable human advancement without the joint participation of females and males in all innovative activities, including science and technology. TWOWS also noted that females still encountered serious challenges in accessing the areas of science and technology. TWOWS further pointed out that science and technology had become important influences in the present days. It is therefore imperative that females come to the front position to participate in shaping the agenda for the future development of the scientific venture. At the same conference, TWOWS appealed to various institutions worldwide to take actions aimed at achieving full involvement of females in science and technology for the benefit of humanity through various means such as, participation in science clubs.

A similar concern regarding access of females to science was also expressed by the World Conference on Science held in Budapest, Hungary, in 1999. It stated:

> Equal access to science is not only a social and ethical requirement for human development, but also essential for realizing the full potential of scientific communities worldwide and for orienting scientific progress towards meeting the needs of humankind. The difficulties encountered by women, constituting over half of the world's population, in entering, pursuing and advancing in a career in the sciences and in participating in decision-making in science and technology should be addressed urgently (World Conference on Science, 1999).

The above concern is still valid in Zambia even in the present days. Thus, still needs attention.

Before the 1990s, not much emphasis was placed on female pupils learning science, mathematics and technology, particularly at senior secondary school level and in higher institutions of learning in Zambia. As a result, very few female pupils in comparison to male pupils studied science subjects and technology in Zambia. In some cases, female pupils studied one science subject only; for example, biology or human and social biology. However, in the mid-1990s, there was a realisation that providing science, mathematics and technology education to more female pupils in Zambia was important (MoE, 1996; MSTVT, 1996). In view of this, a number of initiatives were undertaken in Zambia to improve access and learning of science, mathematics and technology by female pupils. One such initiative was the formation of an association in 1997 called Zambia Association for Women in Science and Technology (ZAWIST) by females in science and technology based careers. One of the goals of this association has been to increase the enrolment of female pupils in science and technical subjects as well as improve their performance in these subjects (ZAWIST, 1998; 2000). There are various ways ZAWIST has been trying to achieve its goal, such as holding career talks with female pupils to expose them to various job opportunities available in science and technology fields, as well as organising open days for them (ZAWIST, 1998; 2000).

A project called Female Education in Mathematics and Science in Africa (FEMSA), which ran from July 1998 to June 2001 also focused on improving female pupils' access, participation and achievement in the areas of science, mathematics and technology subjects at basic and high school levels in Zambia. Among the activities the project undertook to achieve its objectives were: (i) to commission a study to investigate female pupils' participation and achievement in SMT subjects, the difficulties they experienced in learning SMT and the reasons for these difficulties; (ii) and to organise a national conference involving different interested parties in girls' learning of SMT subjects. Through this conference, participants were sensitised and awareness raised on the importance and status of female pupils' participation in SMT subjects through discussions in plenary sessions (FEMSA-Zambia, n.d.). O' Connor (2001) reports that the mid-term review of FEMSA revealed the following changes as a result of the FEMSA project activities among female pupils in FEMSA schools: girls' self-confidence improved and performance in examinations became better; improved participation of girls in SMT subjects; support from parents, male pupils and school administrators on female pupils studying SMT subjects.

Following the end of the FEMSA project, FAWEZA embarked on activities aimed at promoting participation of female pupils in science, mathematics and technology. In this regard, FAWEZA took over the activities FEMSA project was doing because there was a feeling among FAWEZA members, that the activities FEMSA was doing were important and therefore needed to continue. One of the activities FAWEZA undertook was to organise expositions for teachers involved in the teaching of science, mathematics and technology because they were recognised as critical in improving the performance of female pupils in SMT subjects. At these expositions, teachers demonstrated projects in teaching methodologies and improvised teaching/learning aids meant to improve the learning of SMT subjects by female pupils. The subjects covered were physics, chemistry, biology, agricultural science, environmental science, technology subjects (home economics, fashion and design, crafts, woodwork) and mathematics (Mumbula, 2005). The reasons for the expositions included sensitising teachers to be gender sensitive during lesson presentation, expose teachers to varying innovative methodologies in SMT, provide opportunities to teachers of SMT to exchange ideas as well as to motivate them to encourage female pupils to take up SMT subjects (FAWEZA, 2007). However, it is not clear whether these interventions encouraged more female pupils to join clubs such as JETS since no study had been undertaken to investigate this issue.

Another activity FAWEZA undertook was to organise girls science camps during school holidays for purposes of interesting female pupils in science, mathematics and technology as well as enhancing their learning (FAWEZA, 2003). In this regard, prize winning teachers from the SMT Teachers' Exposition were requested to present lessons on selected topics to female pupils during these camps. Furthermore, female educationalists that had done extremely well in the science and technology fields were selected as role models to give career talks to participating female pupils in order to encourage them to take up SMT subjects.

FAWEZA also organises Junior Tele-Quiz competitions (these are competitions between schools which are televised) whose aims are: to increase the number of female pupils learning SMT subjects; improve participation of female pupils in SMT subjects; raise the self-confidence of female pupils taking SMT subjects and raise their scores in examinations. Quiz questions are taken from the following categories: biology, chemistry, physics, mathematics and general knowledge from grades eight-nine syllabus (Makumba, 2005). Regarding the impact of this activity on pupils, one informant revealed that no evaluation had been undertaken to determine its effect on female pupils. Therefore it is not known whether or not it has had an effect on female pupils. It is however, noted that in some competitions, female pupils have performed better than boys. However, the same informant revealed that a simple survey showed that most female pupils were not watching this programme for one reason or another. Therefore, it was unlikely that it would have an effect on them. It is not known whether or not the interventions given above encouraged some female pupils to join JETS Club.

FAWEZA also provided about 150-200 technical scholarships for female pupils to study science, mathematics and technology subjects at any national technical schools within Zambia. However not many female pupils took up these scholarships. One possible reason could be that they had a negative attitude towards science, mathematics and technology. It could also be that they were still of the view that they could not manage to learn these subjects since society perceived them to be too demanding mentally. Although scholarships have been given, the impact they have had is not known.

UNESCO-CASTME (2001) regards access to science and technology education as a right of female pupils. Furthermore, there has been a lot of gender related initiatives in Zambia under the United Nations Development Programme. Organisations such as UNESCO and UNICEF have been involved in spearheading the promotion of female participation in education and in particular in science, mathematics and technology education in Zambia.
UNESCO has provided support for increased education of girls in SMT through the Zambia National Commission for UNESCO (Zambia National Commission for UNESCO, 2008). One activity undertaken to improve participation of female pupils in science education by UNESCO was to carry out science camps for girls only at provincial level. Eight science camps had been held by the end of 2007. During these camps, lessons are conducted in biology, chemistry, physics and mathematics using gender sensitive methods of teaching and learning. Practical approaches are encouraged during these camps (Zambia National Commission for UNESCO, 2008) in form of experiments, group discussion and presentation by pupils. Other activities undertaken during science camps comprise talks aimed at motivating girls, career guidance talks and study tours to science related industries. To give support, the Zambian government in 2000, through Gender in Development Division put in place a science and technology policy, which recognised the value of involvement of both females and males in science and technology (GDD, 2000). All these steps taken are aimed at improving the girl's access, progression and completion rates in schools. However, despite all these interventions, girls are still disadvantaged and this may explain why there could be a few of them joining clubs such as JETS. But the few

who join could be facing some challenges. However, this is not known yet and it requires further investigation.

Other steps taken to improve access and participation of female pupils in SMT subjects were that two national technical high schools which were once for male pupils only, opened their doors to female pupils as well in the 1990s (Kasonde-Ng'andu *et al.,* 2008). However, this seems not to be in the best interest of female pupils because there are more boys in these schools than girls. For instance, in a class of 40 pupils, there may only be 3 girls. In such a situation, girls tend to be inactive during lessons for fear of being laughed at by boys in case a mistake is made when responding to a question. Therefore there are question marks whether or not this has been the most appropriate way of promoting access and participation of girls in SMT subjects. The Zambian government also built a technical high school for girls only in the Copperbelt province. This school offers science and technical subjects mainly to female pupils. Another technical high school for girls only is under construction in the Central province of Zambia. With all these steps taken, it was expected that the boy/girl ratio in schools to improve and possibly even the numbers of girls joining the normally perceived boys clubs such as JETS. Therefore, this was a cause for research to find out what motivates the few female pupils who join such clubs and possibly also what challenges they face from their fellow female pupils who shun such clubs and by some male pupils who wrongly think clubs such as JETS are for boys alone.

In March 2011, the then Zambian Republican President also added his voice to the need for female pupils to receive education in science, mathematics and technology. In his speech on the International Women's Day, on 8th March 2011, he pointed out that in the search to attain advancement in education, training, science and technology, the country could not afford to ignore women and girls who made-up over 50% of the Zambian population (*Zambia Daily Mail, March 9, 2011*; *Times of Zambia, March 16, 2011*). He went further to direct all learning institutions offering mathematics, science and engineering programmes to increase the enrolment of girls (*Zambia Daily Mail,* March 9, 2011). However, the country still waits to see if at all this good directive will be implemented since there has been change of government in Zambia starting from 20th September 2011.

1.2.6 The Junior Engineers, Technicians and Scientists Club

In addition to providing science and technology education during time-tabled lessons in schools, the Ministry of Education in 1968 established the Junior Engineers, Technicians and Scientists organisation with a secretariat in the School of Engineering of the University of Zambia. This organisation introduced the JETS clubs in schools as an extra-curricular science activity to provide supplementary opportunities for pupils to engage informally in scientific, technical and technological activities outside time-tabled science lessons. This strategy has also been supported by Onwu (1992), who argues that if a nation is to have human resource that is scientifically and technologically literate, there is need for supplementary intervention strategy in schools.

Initially, JETS clubs were established only in secondary schools. However, since the 1980s, they have spread to basic schools which incorporate primary schools (Kavumba, 2005). JETS clubs are also found in some private secondary and primary schools. For administrative purposes with respect to JETS, Zambia is divided into 11 regions and each region has a JETS regional organiser. At school level, there is a JETS Club patron and an assistant JETS patron. Patrons are teachers who provide guidance to pupils in this club and also act as a link between pupils, school administration and regional organisers.

JETS clubs were introduced in schools to enhance pupils' acquisition of scientific and technological knowledge, skills and attitudes. Some of the objectives of school JETS clubs are: (i) to popularise science and technology among pupils, (ii) to give pupils an opportunity to learn and apply scientific principles in the design and construction of technical projects, (iii) to help pupils in discovering their own abilities, aptitude and interests, (iv) to help pupils learn how to carry out research work leading to the preparation and presentation of technical reports (Musonda, 1990).

In order to achieve the above objectives, pupils are encouraged to engage in various types of scientific, mathematical and technological activities which are intended to discover and develop the creative and innovative impulses in pupils. This point is very crucial in several respects for a developing country like Zambia but which, unfortunately, has not been harnessed to the full by relevant stakeholders. In most cases, JETS Club meetings are held once a week after lessons in schools. One of the activities JETS Club members are expected to carry out is a project. This is an extended investigation into an area of interest related to science, mathematics or technology. Club members decide what kind of a project they would like to do. They may do a project individually or in pairs. They can do projects in biology, chemistry, physics, mathematics, entomology, agricultural science , technology or village development at primary level, junior secondary level and senior secondary level.

Apart from working on a project during club meetings, members also teach themselves. In this case, some members research on a topic and then they present the topic to other members of the club. Club members are also given an opportunity to seek clarification on issues they do not understand during formal lessons from other members of the JETS Club. They also discuss past examination question papers as well as engage in quizzes and Olympiads at school level. Furthermore, they participate in JETS fairs at school, regional and national levels.

Each school has its own JETS fair known as school fair, where members of the school JETS Club present reports on activities they have undertaken in the previous years in the areas of project work and research work and so on. Such reports are expected to be accompanied by displays such as charts, models, diagrams, specimens, exhibits or written and live experiments (these are experiments running). Assessment of these displays is done by teachers within the school and, where possible, the school may invite knowledgeable persons within the local community to participate as adjudicators.

The school fair is followed by the regional JETS fair. Project competitions at regional JETS fairs are organised at the following levels; primary (grades 1-7), junior secondary school (grades 8-9) and senior secondary school (grades 10-12). Participants at the regional JETS fair are pupils who get first positions in the school fair. At primary level, projects are grouped into the following categories; science, mathematics, village development and visual aids. At both junior and senior secondary level, the projects are grouped into the following categories; biology, chemistry, physics, mathematics, entomology, village development and, school apparatus and visual aids. The regional JETS fairs are followed by a national JETS fair, normally held in the first week of August each year. Participants at the national JETS fair are those who get first positions in the regional fair. The grouping of projects at the national JETS fair is the same as those at regional JETS fair. The village development projects category, for example, tries to get JETS Club members involved in solving problems experienced by people living in villages through application of some of the knowledge acquired in science lessons.

Other activities in which JETS Club members compete during the school, regional and national JETS fairs are paper presentations, quizzes and Olympiads. Paper presentation involves in-depth library research on a topic of one's interest, preparing a written report and then making a verbal presentation to an audience. These presentations are open to all those interested in the topics presented, such as JETS Club members from other schools. Members of the audience are given time to ask the presenter questions for more information or clarification on the subject and the presenter is expected to respond.

Another activity which takes place during JETS fairs is a quiz. A quiz is an activity in which oral questions are posed to participants, who are expected to respond orally within a given period of time. Participants are given two minutes to answer the question. At school level, the school picks the best two pupils of any sex to represent it at the regional fair where pairs of pupils from different schools compete and the winning pair represents the region at the national fair. Quizzes are held at three levels (i.e., primary, comprising pupils from grades five-seven), junior secondary or upper basic (comprising pupils from grades eight-nine) and senior secondary or high school (comprising pupils from grades 10-12). At senior secondary level, there are five categories, namely, biology, chemistry, physics, mathematics and general knowledge. The biology category includes questions in agricultural science. There is a quiz master who asks questions, and a time-keeper whose responsibility is to ensure that the set time limit is adhered to, since participants are expected to think quickly and respond within the given time.

JETS fairs also include Olympiads, which take the form of theory and practical written tasks. The questions are normally challenging, and at a level slightly above that of the participants. Olympiads target gifted pupils and the questions are intended to develop thinking, application and analysis of information. Normally, they require thinking above ordinary level material. Olympiads are done at school, regional and national levels. There are three categories, namely, primary (grade seven), upper basic (grades eight-nine) and high school (grades 10-12). The primary category consists of mathematics and science tasks and all questions are theory. The upper basic category also consists of mathematics and science tasks while at high school level, the Olympiads are done in biology, chemistry, mathematics and physics. In each subject, there are theory and practical tasks. Each of the activities done at various fairs is assessed and winners are given presents, certificates or both. However, it was not clear whether or not these activities undertaken in JETS Club were the ones which attracted a few female pupils to join the club.

Unlike in the case of time-tabled science and technological-related lessons, enrolment and participation in JETS clubs is voluntary; that is, pupils make their own decision whether or not to join based on their personal interest. JETS clubs are open to all grade levels as well as to both female and male, and are usually run by science or mathematics teachers known as patrons (Kavumba, 2005). However, it should be noted that apart from JETS Club, there are other extra-curricular clubs in schools which pupils can belong to, such as debate, dancing, girl guides, boy scouts, adult literacy, red cross and many others. Pupils therefore have a choice as to which extra-curricular club they can belong or join. Despite this aspect, very few female pupils joined such clubs like JETS, and it was not clear what influenced the few female pupils to join JETS Club. Furthermore, the few who joined could have been experiencing challenges in various aspects and hence this study.

A recent study by Haambokoma (2010), undertaken in the southern region of Zambia, involving 5 412 female pupils in grades 10-12 in 17 schools (6 schools for female pupils only and 11 schools for both female and male pupils) found that a small proportion of female pupils in the targeted grades chose JETS as their extra-curricular club as Table 3 shows.

Table 3: Number of female pupils in JETS Club and those not in JETS Club

Grade level	Total number of female pupils	JETS Club members	Non-JETS Club members
10	1 755	192 (11%)	1 563 (89%)
11	1 887	218 (12%)	1 669 (88%)
12	1 770	257 (14%)	1 513 (86%)
Total	**5 412**	**667 (12%)**	**4 745 (88%)**

Source: Field data

The small proportion of female pupils in JETS Club was reported in different types of schools (i.e., boarding, day, mission, government, single sex, mixed sex, rural and urban schools) which participated in the study.

Although not all boys choose to join JETS Club, the proportion of male pupils who join JETS Club is always relatively higher than that of female pupils year in and year out. For example, at the 11 co-education schools which participated in the study, the distribution of male pupils in JETS Club in comparison to that of female pupils is shown in Table 4.

Table 4: Number of pupils in and those not in JETS Club at 11 schools

Grade level	Total no. of pupils		JETS Club members		Non-JETS Club members	
	Females	Males	Females	Males	Females	Males
10	1 257	1 261	85 (7%)	183 (15%)	1 172 (93%)	1 078 (85%)
11	1 187	1 237	83 (7%)	197 (16%)	1 104 (93)	1 040 (84%)
12	1 091	1 201	75 (7%)	216 (18%)	1 016 (93%)	985 (82%)
Total	**3 535**	**3 699**	**243 (7%)**	**596 (16%)**	**3 292 (93%)**	**3 103 (84%)**

Source: Field Data

Low levels of participation by female pupils in comparison to male pupils, in science related extra-curricular activities has also been reported in a study conducted in Britain (Breakwell, 1992). This study would have been enriched if the information given in the tables above had included comparisons in relation to the proportion participating in other extra-curricular activities. However, this information proved difficult to obtain. This is because schools offer many extra-curricular clubs and these vary from school to school (MoE, 1996). Therefore to obtain data on how many female and male pupils were enrolled in various clubs at each school and in 17 different schools would have taken a lot of time. Furthermore, this would have been a slight diversion from the focus of the current study.

The decision to voluntarily join JETS Club by some female pupils was against the commonly held perception by pupils in Zambia that JETS Club was a '*boys' club'* since it involved engaging in scientific, mathematical and technological activities which were perceived to be domains for males (Mwase *et al.,* 1999). The perception that scientific and technological subjects or jobs are domains for males has also been reported by researchers in various parts of Africa. For example, Botswana (Duncan, 1989), Sierra Leone (Amara, 1987), Kenya (Marangu, 1987), Uganda (Mulemwa, 1999a), Senegal (Kamara, 1987), Nigeria (Erinosho, 2001a; Okebukola & Agholor, 1991) and Zanzibar (Nassor, 2001). Others scholars who reported about this belief include Baker (1998) and O'Connor (2000). This perception has also been reported by scholars outside Africa (see e.g., Meyer, 1998; McGill & Woudenberg, 2012).

1.3 Statement of the Research Problem

Although a large number of female pupils decide not to join JETS clubs, there are nevertheless some female pupils who decide to join the club. However, to the best of the researcher's knowledge, no studies have ever been conducted in Zambia to achieve knowledge and understanding of reasons behind some female pupils', decision to join JETS Club and engage in its activities, when a large number of them do not. Hence there is no knowledge on this issue. This knowledge gap necessitated the undertaking of this study.

Understanding the factors that influence female pupils' decision to join JETS Club is important. This is because it will bring out strategies that may potentially increase participation in JETS Club by female pupils. It is desirable that more female pupils participate in JETS Club activities because this club provides more learning opportunities (in addition to formal lessons) in sciences and mathematics which are normally perceived as challenging learning areas particularly for female pupils in Zambia. Regarding the same, Hofstein and Rosenfeld, (1996) assert that informal science activities can make an important contribution in making available suitable learning opportunities for learners and exciting them to learn. Furthermore, studies done elsewhere have established that female pupils who have participated in similar clubs like JETS Club have acquired knowledge, skills and attitudes which they need to lead a socially responsible life (Agholor, 1994; Eastwell &Rennie, 2002; Nchesi, 2001; Fashola,1998). Participation in afterschool science activities by females pupils has also been reported to have resulted in improved enrolment in STEM programmes in institutions of higher learning (Fadigan & Hammrich, 2004).

1.4 Purpose of the Study

The main purpose of this qualitative study was to understand influences on female pupils' decision to join the Junior Engineers, Technicians and Scientists (JETS) Club when a large number of their fellow female pupils decided not to want to join.

1.5 Research Questions

The study sought answers to the following questions:

1. What factors might have influenced female pupils' decision to join JETS, a club erroneously perceived to be a boys'?
2. What benefits (if any) do female pupils acquire from participating in JETS Club activities?
3. What challenges (if any) do female pupils encounter as a result of their joining of JETS Club and participating in its activities?
4. What do female pupils in JETS Club think might have influenced most of the female pupils not to join JETS Club?

1.6 Significance of the Study

No studies, to the researchers' knowledge in Zambian have been undertaken since the inception of JETS clubs in schools to understand factors which might have influenced female pupils' decision to join JETS Club which is perceived to be a club for boys. Therefore, there is a knowledge gap. This study is, therefore important in two ways: firstly, it would generate new knowledge which may help society to understand why some Zambian female pupils decide to join a club perceived to be for male pupils other related issues, thereby making an original contribution to knowledge in this area.

Secondly, It is also hoped that the information generated by this study could be useful to various stakeholders in science, mathematics and technology education. The Zambian National JETS Steering Committee, the National JETS Secretary, regional JETS organisers, science and mathematics standards officers and head teachers' associations are some of the organisations concerned with promoting the smooth running of JETS clubs in schools. School JETS advisers or patrons are also stakeholders who are involved in encouraging pupils to join the JETS clubs and also in providing guidance and support to pupils in these clubs. Organisations such as the Forum for African Women Educationalists in Zambia (FAWEZA), Zambian Women in Science and Technology (ZAWIST), Equity and Gender Unit of the Ministry of Education, United Nations Educational, Scientific and Cultural Organisation (UNESCO) are also instrumental in promoting access and participation of female pupils in SMT in schools.

Others who may find the findings of this study useful include the Zambian Ministry of Education by providing an empirical basis for decision making regarding improvement of access and participation of female pupils in the areas of science and technology education, science teacher educators who are involved in the preparation of science teachers for possible positions in JETS Club as patrons, or advisors in schools on what kind of motivations and conditions they should create in order to increase the number of female pupils joining JETS Club. Other researchers may find the generated information to be important as a source of information for further research.

1.7 Theoretical Framework

The study was guided by three theoretical perspectives, namely, the Feminist Theories, the Self-efficacy Theory and the Expectancy-Value Theory. These theories were selected to guide this study because they have some relevance on decisions or choices people make, which is the focus of the current study.

1.7.1 Feminist Theory

Feminist theories focus on the under-representation of women in various domains of life. They try to comprehend how imbalances existing between men and women in various sectors of life come about and make suggestions on how these challenges (such as discrimination) can be dealt with. These theories originated from the feminist movements which started in Europe and The United States of America (Philips, 2004). At that time, women experienced discrimination in a number of areas. There are different areas where women were discriminated or dominated by men. This led to emergence of different feminist theories whose aim was to address issues of gender inequality in various areas (Brickhouse, 1998).

One area where feminists have had a concern with respect to gender inequality is in science (Wajcman, 2007). This area has been considered by feminists as a source and a locus of inequality between males and females (Wylie, Potter & Bauchspices, 2012). For a long time, the institutions of science have been known to be dominated by men (Harding, 1998, Bloor, 2009; Wajcman, 2007). Feminists try to transform these institutions such as science which limit access of women (Brickhouse, 1998). There are a number of feminist theories (or critique on science) which have been advanced to try to address gender inequality in the science domain (Brickhouse, 1998; Sinnes, 2005; Wajcman, 2007). For the purpose of this study, two feminist theories or critiques of science will be discussed here. These are liberal feminist theory and radical feminist theory.

Liberal feminist perspective: The liberal feminist theory focuses on the issue of accessibility and participation in science. The liberal feminists' wish is to get large numbers of female pupils participate in the science activities. According to this theory, science is universal, open, value-free and objective. It is also said that it is gender neutral, meaning that scientific knowledge is not biased towards feminine or masculine (Wacjman, 2007), and that it is not influenced by scientists and the environment they are in. Because of the above perspectives, they have on science, liberal feminists do not question the structure and practice of science (Brickhouse, 1998; Wacjman, 2007; Harding, 1986). In other words, they do not see anything wrong with science content and practice. Thus, they do not raise the issue of transformation of science to take into account females. Liberal feminists also believe that females and males are the same intellectually (Brickhouse, 1998; Sinnes, 2005), meaning that both females and males can participate equally in science based-activities as well as in the advancement of scientific knowledge (Harding, 1992).

The liberal feminists hold responsible females for their under-representation in science and science based-activities (Wacjman, 2007; 1991). In particular, they attribute the under-representation of women in science to the social environment they are brought up in, such as an environment where there are no role models, their ambitions, depending on their future aspirations, whether one could pursue a non-science career, levels of schooling and their belief, in case they might hold the belief that they are not good in science. Thus, gender inequality in science is attributed to factors outside science and not to the nature of science and scientific knowledge (Harding, 1986). The liberal feminists believe that if females were given appropriate chances and motivation, they could enter the science domain (Wacjman, 2007), which is dominated by males because they have the mental ability to do so.

Thus, females who decide to participate in science and science-based activities, which are considered to be men's activities, do so because they think that they have the same intellectual abilities as males who engage in science based-activities and that they also have a right to do so. Could it be one reason why some female pupils decide to join JETS Club? According to the liberal feminist theory, if more females enter the science domain, it will increase the number of scientists and enhance the quality through competition. However, liberal feminists propagate this, will not change the nature of science (Harding, 1992), which according to them is alright as indicated on page 39. Liberal feminists also are of the view that technology, engineering and mathematics are gender-neutral. The under-representation of women in technology, engineering and mathematics is due to their self-exclusion. Therefore, women have to transform in order to succeed in these fields (Grint & Gill, 1995). They also posit that interventions such as mentoring, role modelling and after-school science activities can increase female pupils' self-efficacy, participation and success in science.

The liberal feminist perceptive has however, been critiqued. One weakness advanced is that it considers females as being the same as males. Thus, are capable of doing what males can do. This requires females to transform some of the their feminine characteristics into male characteristics (Wacjaman, 2007). The second criticism is that according to the liberal perspective, male traits are considered to be more important than female traits (Tong, 2000), an issue some people do not agree with. The third criticism against the liberal feminist perspective is the view it holds that science is gender neutral when it is said to be not. The fourth criticism against liberal feminist perspective is the liberal feminists' consideration of masculine levels of attainment as the yardstick for accomplishment (Phipps, 2007) which may not be correct because some females can achieve beyond that. Although the liberal feminist perspective has some weaknesses which are given above, it is useful to this study in that it provides some guidance on what would have influenced some female pupils to decide to join JETS Club. For example, it could be that some female pupils decided to join JETS club because they were of the view that there was no difference in terms of mental ability with male pupils who were in JETS Club.

Radical Feminist Perspective: The radical feminists posit that science (content and practice) is not objective, value-free and gender neutral because it is founded on masculine practice as understood by men, instead it has a masculine bias. It is also argued that science is loaded with descriptions that make the masculine dominant and the feminine subordinate (Baker, 2003). Furthermore, most of the research activities undertaken in science and outcomes of such enquiries are centred on man. For example, male samples are used for scientific investigations and the results emerging from such investigations are generalised to women (Turner, n.d.). Furthermore, it is argued that the key actors in the generation of scientific knowledge are males in the western countries (Harding, 1986) while women play a very low profile in this process. Since males are the major actors in science, scientific knowledge development and the resultant scientific knowledge assume characteristics such as remoteness, abstractness, impersonality and objectivity, which are linked with males.

Thus, science is viewed as being difficult and intellectually demanding and given a masculine image (Jones et al., 2000; Rosser, 1990; Archer & Freedman, 1989; Harding, 1991; Miller et al., 2006) as well as stereotyped as a domain for men (Kahle & Meece, 1994). Such science elitist image and implied messages of science being challenging and hence requiring those who participate in it to have an exceptional ability becomes a hindrance to participation in science for some people. This exclusionary system mainly affects females although some males are also affected as pointed out by feminists (see Haraway, 1991; Harding, 1986; Keller & Longino, 1996; Scheiebinger, 1999). This masculine and mentally demanding representation of science keeps some females away from science (Harding, 1998). In view of the fact that females do not equally participate with males in the process of production of scientific knowledge, science does not have certain feminine characteristics that would broaden and enhance its importance to human beings (Sinnes, 2006). The views given above on science also apply to mathematics and technology. To address gender inequalities in science, radical feminists are of the view that there is need to transform science from its masculine nature feminist science to take into consideration interests and needs of females (Rosser, 1990).

Radical feminists also hold the view that females and males are different in terms of knowledge, skills and attitudes. Therefore, they have different approaches in their engagement in science (Harding, 1986). It is argued that females use different enquiry strategies in their approach to science. Consequently, they would develop a science which is would make a more meaningful contribution to society (Rosser, 1990). Therefore, radical feminists argue for increased participation of females in science because they are of the view that female scientists would contribute to science in a more appropriate way than men scientists would do.

However, radical feminists have been criticised for ignoring the variations which exist among females in terms of their age, race and class. In other words, they assume that all females are the same which is not the case. Furthermore, some scholars (e.g.,Brickhouse, Lowery & Schultz, 2000) argue that regarding females as different from males promotes stereo-typed pictures of females.

Although the radical feminist perspective has some weaknesses which are given above, it is useful to this study in that it provides some guidance on what might have influenced some female pupils decide to join JETS Club. For example, it could be that some female pupils decide to join JETS Club because they think that they are better than male pupils mentally and that they have a special scientific contribution to make to JETS Club activities which male pupils are not able to contribute.

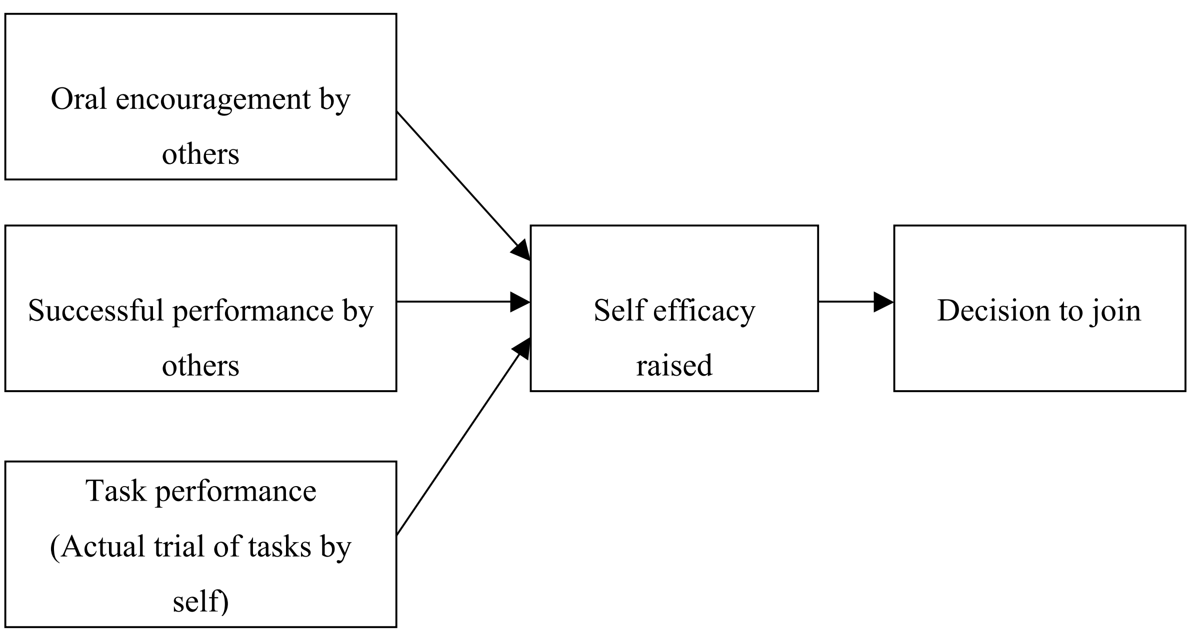
1.7.2 Self-efficacy Theory

The Self-efficacy Theory was developed by a professor of Psychology at Stanford University in the United States of America called Albert Bandura (Bandura,1986, 1997). This theory was initially developed to explain how people learn new behaviours from experiencing the actions of others. However, it has also been used to explain why people make certain decisions or what influences decisions they make. It stresses the importance of self-efficacy in one's decision to participate in an activity. According to this theory, people decide to engage in or keep away from a specific task based on their self-judgment of their ability to accomplish the task (Bandura, 1986). In other words, people decide to engage in activities in which they feel competent and confident and avoid those activities they think they are not able to do (Pajares & Schunk, 2001).

According to this theory, some of the factors which can influence one's self-efficacy are verbal persuasion, vicarious learning and task performance (actual trial of the task). According to Bandura, verbal persuasion refers to oral encouragement and support one receives from significant others. These significant others could be friends, teachers or family members who tell a person that she or he has the capability to successfully perform a given task or activity required of him or her. For example, if peers, members of the family or science teachers tell a pupil that she can successfully participate in JETS activities, her own beliefs that she can, are likely to be raised and she will decide to join the club. This factor is also referred to as 'social persuasion' (Bandura, 1994).

Vicarious learning refers to influences arising from seeing others (that is role models) engage in an activity or task which they participate in successfully. Bandura (1994) argues that watching people or fellow pupils similar to oneself, succeed through a sustained effort raises one's beliefs that he or she too can succeed in a given task. In other words, the success of other pupils makes one think she or he can do it too. Bandura (1994) refers to role models as 'social models'. Task performance refers to the actual trial or doing of the task. If an individual engages in an activity and performs well, then the individual is motivated and is likely to decide to perform that activity in future (Pajares, 2002). However, poor performance will lead to an individual deciding not to participate in that activity any more. Apart from influencing decisions to do something, self-efficacy has also been associated with the quality of effort and the willingness to persist in an activity (Pintrich & Schunk,1996). Figure 5 shows a diagrammatic representation of a modified self-efficacy theory.

Figure 5: Diagrammatic Representation of a Modified Self-efficacy Theory.



Source: Adapted from the Self-efficacy Theory (Bandura,1986; 1994)

Although the theory given above is based on studies done outside Zambia, which were not focussing on JETS Club, it gives some useful insights to the current study. However, it may not be correct to say that oral encouragement, successful performance by others, and task performance are some of the factors which influenced some female pupils who are in JETS to join the club in Zambian schools, hence the need for this study.

1.7.3 Modern Expectancy-Value Theory

Another theory advanced to explain influences behind people's decisions or choices is the Modern Expectancy-Value Theory developed by Eccles, Adler, Futterman, Goff, Kaczala, Meece and Midgley in 1983 (Eccles *et al.,*1983). This theory originated from Atkinson's (1964) Expectancy-Value Theory (Eccles & Wigfield, 2002). The modern expectancy-value theory suggests that choice or decision to engage in a task or an activity/club is directly influenced by two beliefs. These are beliefs related to expectancy of achievement and beliefs related to the value of the task. That is, the degree to which one values the task, activity or club (Eccles & Wigfield, 2002).

Thus, according to the Expectancy-Value Theory, expectancy of achievement beliefs (i.e., their beliefs about how well they will do on the activity) and task-value beliefs (the extent to which they value the activity) are key determinants of choices or decisions people make (Eccles et al. ,1983). The two beliefs are examined below.

Expectancy of achievement beliefs

According to Xiang *et al.,* (2003), Eccles and her collaborators believed that expectancy of achievement beliefs were of two types, namely, beliefs about expectations for success (i.e., a person's belief about how well he or she thinks will perform on an upcoming task or activity in the short term or long term) and beliefs about ability (Eccles *et al.,* 1983).

Task-value beliefs

With respect to the task-value part of the theory, Eccles *et al.,* (1983), Wigfield (1994) and, Eccles and Wigfield (2002) identified four task-value related beliefs which they believed influenced a person's choice/decision of or persistence in or performance of a task or an activity. These are:

Attainment value (success) – which means the personal importance of doing well or succeeding on the task or activity in question. This could be the importance of attaining a cognitive goal (e.g. creating something new) or attaining an affective goal (such as happiness of being successful). It also includes the importance of doing well in a task for approving or disapproving one's self-schema (i.e., information about the self based on previous and current experiences) in terms of their self-image;

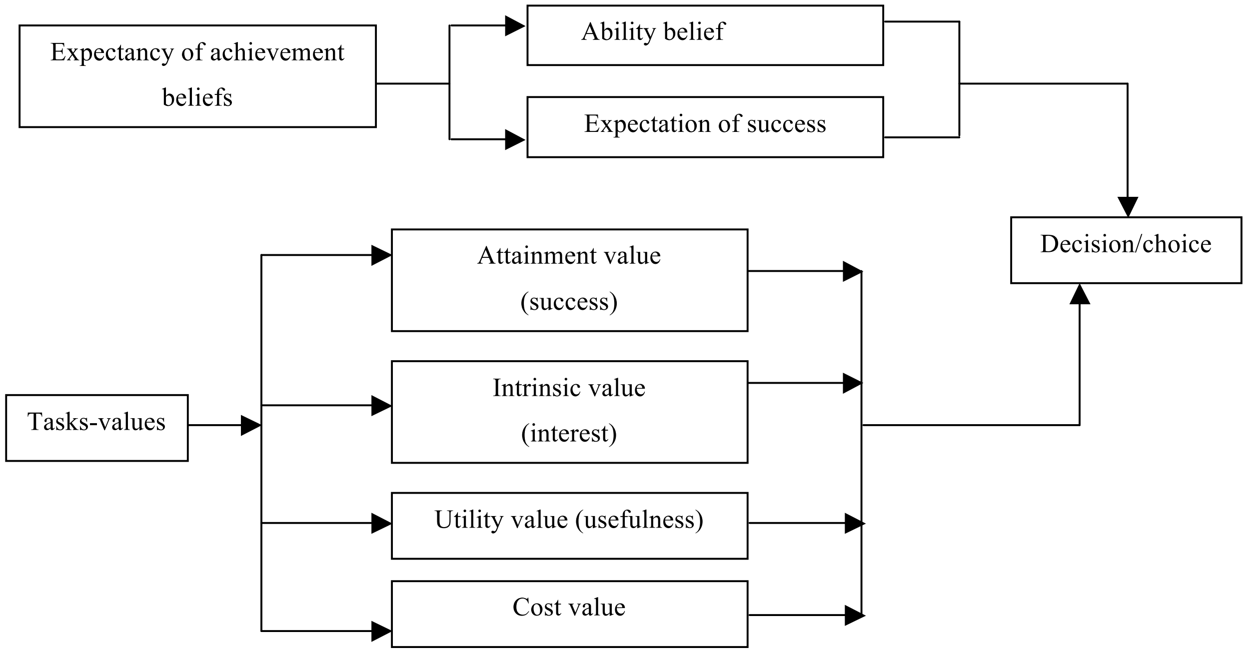
Intrinsic value (interest) – meaning the pleasure or enjoyment a person derives from doing or participating in an activity (Wigfield, 1994). It may also refer to the interest a person has in the activity (Eccles & Wigfield, 2002) or the subject. It also includes the extent to which a pupil expects to enjoy participating in an activity. Intrinsic value is in some cases referred to as interest-enjoyment value.

Utility value (usefulness) – meaning the seeming usefulness or helpfulness of an activity for achieving one's personal goal in life. For example, some pupils decide to engage in certain activities or take a particular subject because they want to do a certain course in future (Wigfield, 1994). This may also include a situation where a student wants to be in the same club as his or her friends.

Cost value – refers to negative aspects related to one option as compared to other option or decisions. These off-putting aspects may be loss of time and energy for other activities, performance worry in respect of participating in the activity and fear of failure or fear of disappointing other people as well as the amount of effort and time required to succeed in an activity (Eccles *et al.,* 1983; Eccles, 1987; 1994; Wigfield & Eccles, 2000).

It, therefore, means that according to this theory, a person would decide to join a club or do a particular activity, if he or she thought that he or she would succeed, was able to do it and he or she liked the activity. He or she would also decide to join or participate in an activity, if he/she regarded it to be important, useful and believed that the costs of participating in the task or activity were low (Stuart & Whaley, 2005). Figure 6 shows a modified diagrammatic representation of Eccles et al. (2002) Expectancy-Value Theory.

Figure 6: Diagrammatic representation of a modified Expectancy-value Theory.



Source: Adapted from Eccles et al. Expectancy-Value Theory/Model (Eccles and Wigfield, 2002)

Modern expectancy-value theory was initially developed to explain gender differences in pupils' choice/decision of whether or not to continue studying mathematics in high school or beyond high school (Wigfield, 1994). Since then, this theory has been used as a theoretical framework to study choices/decisions which people make in various situations for instance in taking certain subjects such as physical education, (Xiang *et al.,* 2003); enrolment decisions in science courses (Barnes, McInerney & Marsh, 2005; Cleaves, 2005) and students' decision of taking certain college majors (Lackland, Childers & Richard, 2001). It has also been used to understand why there are few females in mathematics and science-related careers (Eccles, Barber & Jozefowiez, 1999; Eccles, Jacobs & Harold, 1990) as well as to examine gender differences in computer attitudes, skills and perceived ability (Teasdale & Lupart, 2001). Weinberg *et al.,* (n.d.) used part of this theory to examine the impact of Robot projects on girls' attitudes toward science and engineering. Others who have used the Expectancy-Value Theory are Eidelman and Hazzan (2007), who used it in their study of high school students doing advanced-level computer science in Israel high schools as well as Lupart, Barva and Cannon (n.d.) in their investigation of what happens when girls gifted in science grow up. Chimwayanga and Davies (2002) used Eccles *et al.,'s* model as a theoretical framework in their investigation of girls' decision-making with regard to participation in design and technology subjects in Zimbabwean secondary schools. However, it is not known whether one's ability belief, expectation of success, attainment value, intrinsic value and utility value have had some influence on female pupils joining JETS Club in Zambia. It is also not known whether female pupils who joined JETS Club encountered some cost-related issues i.e., challenges.

Theories reviewed above focus on issues which influence decisions. Thus, they shed some light on possible factors which may have influenced some female pupils in Zambia to join JETS Club, which is the focus of the current study. Another strength of these theories is that they are based on extensive empirical studies conducted in different parts of the world. They have also been used by different researchers for a long period of time on studies related to pupils' choices or decisions similar to the current study. However, these theories also have some limitations in relation to the current study. One limitation is that these theories emerged mostly from empirical studies undertaken largely in developed countries, in particular, in the United States of America. Therefore the influences on decisions identified by the three theories given above may not be the same factors which influenced the few female pupils who decided to join JETS Club in Zambia, which is the focus of this study. This is because the context for female pupils in Zambia is different from that in the United States of America. Thus, it is not known whether or not some of the female pupils who decided to join JETS Club in Zambia were influenced by motives identified by the three theories given above. Another limitation is that the costs identified by the Expectancy-Value Theory developed in the United States may not be the same challenges which female pupils in JETS Club in Zambia experience because of the different environments.

1. 8 Structure of the Thesis

This thesis is structured into six chapters as follows:

Chapter one is the introductory chapter. In this chapter, the rationale and motivation for undertaking the study, the background and context of the study, the research problem, purpose of the study, research questions, significance of the study and theoretical frameworks are given. This chapter ends with an overview of the thesis.

Chapter two contains the literature review, structured into broad themes as follows: arguments for encouraging more female pupils into science, mathematics and technology education, science and technology based core and extra-curricular activities, types of science and technology-based extra-curricular clubs, benefits of participating in science and technology based extra-curricular activities, nfluences on decisions made by pupils and students with respect to SMT field.

Chapter three is the methodology chapter which addresses the issue of how the study was conducted. In this chapter, a description of the broad methodological approach and the rationale for choice of such approach is presented. Also given is information on the following aspects: research sites; study population, participants and selection of participants; instruments used to collect data and how they were validated; method used to collect data. This chapter is closed by outlining steps taken to ensure validity of findings.

Chapter four presents data provided by participants with respect to research questions. All findings are presented in this chapter.

Chapter five contains the discussion and interpretation of findings. This chapter begins with a discussion of findings concerning what influenced female pupils' decision to join JETS club. Then the discussion in relation to paybacks, challenges of participating in JETS activities and why some females do not join JETS Club from the perspective of female pupils in JETS clubs is presented.

Chapter six is the conclusion chapter. In this chapter, the contributions which the study has made to knowledge, implications of the findings, limitations and areas for further research are presented.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Arguments for Encouraging More Female Pupils into Science, Mathematics and Technology Education (SMTE)

Educating female pupils in science and technology has been recognised as important and beneficial worldwide (see e.g., Agholor & Okebukola, 1998; Bowman, n.d.; Erinosho, 1994; Harding, 1992; Reddy, 1998; Sinnes, 2005; Oldham, 2000; Mulemwa, 1999a; Third World Organisation for Women in Science, 1999). The benefits claimed are at three levels, namely personal, societal and national.

At personal level, one argument advanced is that educating female pupils in science and technology enables them to acquire the necessary qualifications to enter science and technology-related jobs, such as engineering and medicine (Reddy, 1998), which are mainly dominated by males in countries like Zambia. It is argued that if females entered science-based careers, it would in turn improve the economic status of these females and reduce the gender pay gap since these jobs are well-paying. However, non-science based careers such as accountancy and law are also well paying currently in Zambia. This would also mean girls acquiring a good understanding and mastery of the environment in which they live, and make use of it in a friendly way (Erinosho, 2001a; Reddy, 1998). Another argument put forward is that science and technology are seen currently as tools for a better understanding of the environment and for changing it (Agholor & Okebukola, 1998). Therefore, acquisition of scientific and technological knowledge and skills by females would enable them to survive better in a scientific and technologically-dominated society, which mostly uses scientific and technological devices (Agholor & Okebukola,1998; Reddy, 1998) such as computers and cell phones. However, not all families have access to these gadgets in Zambia. Furthermore, it is argued that if females were scientifically and technologically literate, they would have more opportunities to participate more ably in taking decisions (Sinnes,2005; Welty & Puck, 2001) in their homes and society at large which may require scientific and technological knowhow. It is also claimed that they would also apply scientific principles in daily life, such as preventing and controlling diseases since they take responsibility of family health issues in most homes (Mulemwa, 1999a) in countries like Zambia (Schiebinger, 2010), and also avoid accidents both at home and in their places of work (Sinnes, 2005) which may occur through lack of scientific and technological knowhow. Whenever such accidents happen, they tend to be costly. It is only when these female pupils develop interest in science as a subject that they can eventually join science-related clubs like JETS. As to whether the female pupils who joined JETS Club had in mind the reasons and practical suggestions, put forward above, was not known.

At societal and national levels, a number of paybacks for providing science and technology education to female pupils have been cited. One of them is an increase in the number of technical workers (Bowman, n.d.). For example, the number of female science teachers would increase with an increase in the number of girls in schools accessing science education. Currently in Zambia, there are few female science teachers at secondary school and higher institutions of learning. In Africa, and in Zambia in particular, it is claimed that the human population comprises mostly females, and, therefore, increased participation of this large group of human beings would improve the nations' scientific and technological creative brains which, in turn, could contribute to advancement in science and technology (Oldham, 2000; Boe, Henriksen, Lyons & Schreiner, 2011) as well as in boosting the rate of national development (Agholor & Okebukola, 1998; ZAWIST, 1998). It is argued that women bring certain beneficial aspects to science and technology which men may not be able to bring in science and technology (Rosser, 1990). It is also said that science and technology education provided to females would also enable more of them to take up decision-making positions in society and nations at large (Reddy, 1998). It is further claimed that acquisition of scientific and technical knowledge, skills and attitudes by girls would enable them to function as responsible citizens (Millar & Osborne, 1998) as well as perform responsibilities such as improving family life (Agholor & Okebukola, 1998; Oldham, 2000) and taking leadership in educating children (Sinnes, 2005; ZAWIST, 1998). They would improve family life because some of them may be employed, hence bring home more resources for food, contribute to children's education and be in a position to meet other expenses in the home.

Regarding educating children, a mother who has learnt science and technology could use the knowledge acquired to teach her children, aspects of science and technology and help in their homework involving science and technology. This would be helping the process of teaching as well as the family because if children understood what they were taught, they would perform well in their examination, which would be good for the family. However, it is not known, if the female pupils who join JETS Club in Zambian schools are influenced by the cited benefits. Parental involvement in teaching improves children's achievement, interest in learning and attitude towards schooling (Barba & Reynolds, 1998). In Zambia, generally speaking, mothers are more often at home with children than fathers and, therefore, are more in contact with children. This could be because males have historically been considered to be bread-winners, seeking employment, and hence, there are less females generally in formal employment than males. Therefore mothers not in formal employment are normally at home. In addition to what has been highlighted above, it has also been argued that female literacy in science and technology can reduce mortality rates among children (Agholor & Okebukola, 1998) since females in Africa are generally more in charge of health issues in homes (ZAWIST, 1998), which is the case in most families in Zambia. Females would know how common diseases among family members could be prevented.

Female literacy in science and technology would also mean improved farming and food production (Sinnes, 2005) at both family and national levels since females make up a larger proportion of the agricultural labour force (Schiebinger, 2010). They would know the most appropriate crops to grow in their areas depending on the rainfall pattern and soil fertility. Females would also get to know the most ideal farming methods and the best ways of preserving foodstuffs for future use. However, the argument advanced above could only be possible if the scientific and technological knowhow provided to females is related to farming and issues of food production. So, acquisition of scientific knowledge would be useful to female pupils. However, not all parents think that science is for female pupils and they do not expect them to perform well. Instead, they hold the view that science is much more important for male pupils and expect them to attain better (Andre *et al.,* 1999).

Female pupils should receive special attention with respect to science education because in the Zambian situation, when secondary education was first introduced, not many girls were encouraged to study science, mathematics and technology, which were regarded as domains for boys. Unfortunately, the under-representation of females has continued in subjects mentioned above. Thus, there is need to encourage more girls to study science and technology. The composition of the Zambian population, as mentioned in the introductory chapter, has slightly more females than males. It is, therefore, justified that the ratio of female to male in science and technology fields should be similar to that in the Zambian population (Oldham, 2000). In the case of Zambia, females should not be disregarded in matters of science and technology education. On 8th March 2011, the Zambian Republican President echoed this point (*Zambia Daily Mail, March 9, 2011; Times of Zambia, March 16, 2011)*. Furthermore, in Zambia, women are generally closer to families and community at large than men. Therefore, if there is a need for family and societal development and that science and technology literacy is important to bringing about these developments, then there is also a need to pay special attention to the education of female pupils in science and technology.

Some writers and organisations have pointed out that female pupils have a right to access science and technology education for personal advancement just as male pupils do (Boe, Henriksen, Lyons & Schreiner, 2011; UNESCO-CASTME, 2001). Furthermore, it has been argued by some scholars, that female pupils have the same intellectual ability as male pupils who study these subjects (Sinnes, 2005). Thus, females should be given chance to engage in any science and technology activities. It has also been argued that females bring knowledge, skills, talent and attitudes into science and technology different from those of males (Bloor, 2000). Therefore having more female pupils access science and technology education would improve the knowledge, ability and inspirations as well as enhance the likelihood that science and technology will support the needs of society. Hence, improve the quality of living of different members of society (Oldham, 2000). This is a positive picture being painted here about steps to be taken to improve and motivate female pupils to take science subjects.

2.2 Science and Technology based Core and Extra- curricular Activities in Schools

Since science and technology education is important as indicated above, schools in Zambia provide opportunities to female pupils to learn science and technology. These opportunities may be divided into core-curricular and extra-curricular (MoE, 1996). Core-curricular activities refer to an arrangement in a school system where science and technology subjects are part of the school time-table and learning them is compulsory, which is common in a number of countries. A review of curriculum documents from different countries in Africa such as South Africa (Jacobs, 2000), Botswana (Yandila, n.d), Lesotho (Middleton, 1991), Ghana (Collison & Aidoo-Taylor, 1991), and outside Africa, such as England (Jenkins, 1979; Jenkins, 1989; Dunne, 1998; Waring, 1979; Wellington, 2003), India (Das, 2004) and Japan (Tsukahara, 2004; Takakura & Murata, 1997), as well as in Zambia (MoE, 1996), reveal that science education occupies a core position in the school curriculum at nearly all levels of the education system. In this case, pupils learn science in a formal way, that is, a process of learning where pupils attend compulsory time-tabled and prepared science and technology lessons (Wellington, 2003). The learning process is directed by the teacher and the outcomes of the learning are also clearly stated by the teacher and the school system (Vavoula, 2004). In most teacher-dominated cases, pupils have no say on what they will learn and how they will be taught, and what is taught is part of the national syllabus, leading to pupil assessment at the end of a specified period such as term or year (Wellington , 2003). The situation described is also widespread in Zambian schools with respect to science education (Haambokoma *et al.,* 2002).

In addition to time-tabled science and technology lessons, schools provide opportunities for informal learning of science and technology by pupils, which takes place independently, without being attached to highly directive curricula or instruction (Vavoula, 2004). Informal learning has the following features: pupils participate in the learning activity at their own will; it is not structured; it is not sequenced; no assessment is conducted at the end of the activity and no certificate is given; it is open-ended; pupils decide what they want to do, learn and they are involved in the activity; and it is also not planned and directed by the teacher (Wellington, 1993; 2003). This is also the situation in JETS clubs in schools in

Zambia. This kind of learning which occurs outside school is in some cases referred to as free-choice learning (Falk, 2001). It is important to note that informal learning may not be restricted to the school environment only, this is because it can occur at any place outside the school (Falk, 2001) such as market, bus or rail station and from various sources such as newspapers, radio and television. In the school setting, informal learning takes place outside time-tabled lessons (i.e., normally after classes and does not involve any prescribed curriculum). Schools in Zambia provide for informal learning through extra-curricular activities which normally take place after time-tabled lessons during working days or during the weekends (MoE, 1996).

Although science and technology education are regarded as important for females as pointed out earlier in this chapter, a review of the literature suggests that female pupils' participation levels (i.e., number of female pupils taking science, mathematics and technology subjects, their involvement in these subjects during class activities such as discussions and experiments as well as achievement) in core-curricular science and technology education activities is low in many countries in Africa (Erinosho, 2001a; O' Connor, 2001; Mulemwa, 1999a). Low participation of females in core-curricular science and technology activities is also a problem of the developed world (see e.g. American Association of University Women, 1992; Clewell, Anderson & Thorpe, 1992; Rosser, 1990; National Centre for Education Statistics 2000; Welty & Puck, 2001; Anastasaki, n.d.; Baker, 1998). This may explain why there could be small numbers of female pupils joining clubs such as JETS but reasons why the few female pupils joined such clubs were not known and so are challenges they could have been experiencing.

In Africa, low participation of female pupils in science and technology related activities in comparison to that of male pupils has been reported in a number of countries such as Botswana (Mogotse, 1994); Uganda (SchoolNet Uganda, 2007; FEMSA Dissemination Report No. 5, n.d.); Ghana (Anamuah-Mensah, 1994; FEMSA Dissemination Report No. 5, n.d.); Cameroon (FEMSA Dissemination Report No. 5, n.d.); Zimbabwe (Breda, 1999); Kenya (Eshiwani, 1988); Nigeria (Aguele & Agwagah, 2007; Okeke, 1987); Zanzibar (Nassor, 2001a) and in Zambia (Mwase, Munyati, Nkhata, Tindi, Banda, Mulenga, Lungu

& Yashini 1999; Zambian Women in Science and Technology, 1998). This trend has been reported to be widespread in Africa (Mulemwa, 1999a). It is however, important to note that the low participation of females in science, technology and mathematics in comparison to that of males varies from country to country and from one educational level to another within a country. The low participation of female pupils is also the case in JETS Cub in Zambia.

The small number of females in science and technology has been perceived as a serious problem to personal, societal and national development (Erinosho, 2001b; Nassor, 2001b). For instance, Erinosho (2001a: 14) asserts that "gender imbalance and under-utilisation of women's skills and resources for science and technology constitutes a serious drawback in the development process". As a result of the desire to understand what contributes to low participation of female pupils, a number of studies have been undertaken to establish factors contributing to the poor participation of females in science and technology in a number of countries. These include the United States of America (e.g., Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001; Bowman, n.d.); Canada (Actua, 2003); Cameroon, Ghana, Tanzania, Uganda, Burkina Faso, Kenya, Malawi, Mali, Mozambique, Senegal and Swaziland (O' Connor, 2001); Uganda (Mulemwa, 2002); Nigeria (Erinosho, 2001a; Aguele & Agwagah, 2007).

A study conducted in 1999 in Zambia on participation of girls in science, mathematics and technical subjects (SMT) in primary and secondary schools found that participation of female pupils in these subjects was lower than that of boys (Mwase, Munyanti, Nkhata, Tindi, Banda, Mulenga, Lungu & Yashini 1999). According to this study, in the year 1997, the percentage of boys and girls who had registered for SMT in the grade 12 final examination subject by subject was as follows: additional mathematics, 6.5% boys and 0.9% girls; chemistry, 20.6% boys and 8.3% girls; woodwork, 4.8% boys and 0.3% girls; geometrical/mechanical drawing, 10% boys and 0.5% girls (Mwase et al ,1999). In Zambian learning institutions, woodwork is classified as part of technology (see e.g. MoE, 2003).

These studies on participation revealed a number of factors that contributed to low number of female pupils in science and technology. One of the factors identified is lack of self-confidence on the part of female pupils. In this regard, researchers established that female pupils have a negative perception of themselves as not being able to learn science and technology (Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001; Mwase *et al.,* 1999). In other words, female pupils believe that they cannot learn science, mathematics or technology, because these subjects are demanding (Barba & Reynolds, 1998; Bowman, n.d.; Kelly, 1987; Actua, 2003), in that they involve things like mathematical calculations and abstract concepts which require a lot of thinking and concentration to comprehend, which some female pupils do not like. This kind of thinking has also been reported among female pupils in Zambia (Mwase *et al.,* 1999). JETS club has a number of mathematical calculations but some female pupils still decide to join it.

The social and cultural barrier was also identified as having contributed to low participation of female pupils in SMT subjects. Regarding this aspect, researchers reported that families and society at large do not expect female pupils to be able to learn science and technology and, therefore, no effort is made to encourage them to learn science and technology (Mwase *et al.,* 1999; Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001). As a result, most female pupils are not prepared to go against the expectations of society by pursuing science and technology in which case they can be labelled as 'Geeks' (awkward or unfashionable persons), a term they do not like (Bowman, n.d.). It has also been claimed that learning science is regarded as being of less important to female pupils given the cultural expectations about their future major roles as wives and mothers (Ekine & Abay, n.d.). However, it is important to note that wives and mothers still need scientific and technological knowledge as most of the activities wives and mothers undertake these days involve some scientific principles. It was not known whether or not female pupils who joined JETS Club experienced discouragement from families and society at large and if they did, how they dealt with these.

Parental attitude was also identified as a contributing factor to low participation of girls in science, mathematics and technology. With respect to this, researchers established that some parents expect female pupils to be at home most of the time to assist in various household chores such as cooking, sweeping and looking after children (Bowman, n.d.; Mulemwa, 2002; FEMSA Dissemination Report No. 5, n.d.). This makes it difficult for female pupils to advance in science and technology as they have no time to study these subjects or do homework in them (Mulemwa, 2002). However, this assertion may not be true for some female pupils who attend boarding schools. This is because they have as much time as male pupils to engage in the study of SMT. It has also been observed that even before girls start going to school, during the early socialisation process, they are disadvantaged in science by parents in that they are encouraged to play with dolls instead of materials related to science such as microscopes and electrical materials (Brickhouse, Lowery & Schultz, 2000). As a result of this, girls are made to believe that only boys can engage in science and technology subjects (Erinosho, 2001a). It has also been argued that unlike girls, boys also engage in activities associated with science when they are still young (Agholor & Okebukola, 1998).

Another factor cited to have contributed to low participation is that society at large and female pupils perceive science and technology to be difficult (Adamuti-trache, 2006; FEMSA Dissemination Report No. 5, n.d.), and, therefore, to be an area of study for males only (Kelly, 1987; Actua, 2003; O'Connor, 2001; Hill, Pettus & Hedin, 1990; Kahle & Meece, 1994). Thus, they do not see the value of studying science and technology as females. It therefore means that if this perception has to be changed, society at large as well as female pupils have to be sensitised that this belief is not correct. This perception is also common among female pupils in Zambia (Mwase *et al.,* 1999). However, whether or not the perceived difficult nature of science contributed to some of the female pupils joining science based clubs such as JETS was not known.

Lack of information, mainly from career counsellors in schools, has also been identified as a barrier to female pupils' participation in science and technology education. In this regard, it has been established that lack of information to female pupils regarding possible careers in science and technology fields contributes to female pupils avoiding science and technology (Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001; Bowman, n.d.), since they do not know that science and technology are also career options for them. However, whether knowledge of science-based careers had an influence on some female pupils' joining of JETS club is not known.

Another factor cited as contributing to female pupils' low participation in science and technology is lack of role models (Welty & Puck, 2001). It is stated that female pupils' lack exposure to females who are in science and technology based jobs, such as science teaching, ecologists and engineering. Therefore, they do not see themselves pursuing these careers or holding these positions (Bowman, n.d.; Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001; O' Connor, 2001; Mwase *et al.,* 1999). Role models are important in attracting female pupils into science related fields. For example, a study undertaken in Zambia's neighbouring country, Zimbabwe, which investigated the impact of a role modelling book on career choices of female pupils in the primary school, showed that female pupils responded to female role models in careers that had more males. The book contained actual stories of successful females in fields where males were more. Out of the 45 female pupils in the experimental group who read the book, 73% changed their initial career aspirations from female traditional careers to careers that are dominated by males (Ekine & Abay, n.d). It is also claimed that female role models are important in raising young people's aspirations (Dimitriadi, 2013). However, in some cases, it has been observed that some female teachers who are expected to act as role models to inspire female pupils to develop interest in science, act contrary to expectations in that they tell female pupils that science is very difficult and that it is not meant for every girl to study.

Studies have also revealed that the way some teachers interact with female pupils during science and technology lessons (i.e., their classroom practice) affects negatively the participation of female pupils during such lessons (Bowman, n.d.; Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001; O' Connor, 2001; Mulemwa, 2002). For example, during science and technology lessons, some teachers do not expect female pupils to have the ability to learn science, mathematics and technology (Mulemwa, 1999a). Because of this, female pupils who want to join a science or technology class tend to be discouraged from doing so (Bowman, n.d.). Since teachers are highly regarded by pupils, in whatever small way a teacher discourages a female pupil from science, the resulting effect on female pupils is disastrous, since societal pressures also work against them (Bowman, n.d.). Furthermore, teachers do not make an effort to mentor female pupils during technology lessons (Welty & Puck, 2001). However, it is not known whether or not the few female pupils who join SMT- based clubs such as JETS experience lack of support from teachers.

Even when female pupils are allowed to enrol for science or technology subjects, there tends to be gender bias during lessons reported. For example, boys get more attention from teachers than girls (Baker, 1998). Teachers still expect female pupils to perform poorly during lessons compared to male pupils (Mulemwa, 2002), and direct more questions to male pupils than to female pupils (Brickhouse, Lowery & Schultz, 2000). It is also reported that teachers also allow more 'wait time' for male pupils than female pupils during lessons (Erinosho, 2001a). Furthermore, teachers direct easier questions to female pupils compared to those questions which boys are expected to answer (Brickhouse, Lowery & Schultz, 2000). Low teacher expectation of female pupils' ability to learn science and technology has been cited by Harding and Apea (1990: 8). For example, they describe teachers' differential expectation of female and male pupils as follows "if it's a boy with problems, they say 'you are a boy, you must do better, you must be able to do this. But if it is a girl, they say 'it's alright, you don't need this, you can go off and learn to cook and sew". Unfairness against female pupils during science and technology lessons has also been cited by other researchers (Clewell, Anderson & Thorpe, 1992; Gatta & Trigg, 2001) in mixed science classes and technology lessons (O' Connor, 2001; Crossman, 1984). So whether or not this was what was being experienced by female pupils who join JETS is not known.

Other ways teachers contribute to low participation of female pupils in science and technology is through creating a competitive learning environment during science and technology lessons (Bowman, n.d.; Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001), a situation which some have claimed is enjoyed more by male pupils than female pupils (Brickhouse *et al.,* 2000), on the other hand, female pupils prefer a cooperative learning (such as group work) environment (Baker & Leary, 1995; Schoenberg, 2004). Regarding this issue, a study by Fennema and Peterson (1987) found that competition in a classroom did not assist female pupils to learn, but cooperative learning had a remarkable effect on female pupils' learning. However, it may not be correct to say that all girls enjoy cooperative learning. Some enjoy competing with others, whether with other girls or with boys. So whether or not the desire to compete with others is what made some female pupils decide to join JETS Club is not known. The non-practical or experimental-oriented teaching strategies used by science teachers during lessons, which do not motivate female pupils were also cited as factors contributing to low participation of female pupils in science (Mulemwa, 2002). Whether or not the opportunities to engage in practical work in SMT-based clubs such as JETS influenced the few female pupils to decide to join JETS Club is not known.

Other issues identified as having contributed to low participation of female pupils in SMT include: circumstances in which female pupils found themselves, surrounded mostly by male pupils (Bowman, n.d.); not liking the idea of being the first few to join the boys; lack of interest among female pupils to study science and technology; the thinking held by some female pupils that science was dirty and that it was not safe because explosions could occur when involved in a science or technology activity (Actua, 2003); the usual unclean, rough and strenuous learning environment, especially in case of technology education (Welty & Puck, 2001); and perception by female pupils that science had no relevance to their daily life (Kelly, 1987).

Unwillingness by some female pupils to demonstrate that they are good in science and technology since these areas are believed to be domains for male pupils was also reported to contribute to female pupils' low participation in science and technology education (Bowman, n.d.). However, It is not known whether or not the desire to show that females were capable of undertaking scientific and technological activities motivated some of the female pupils to join JETS Club. Some female pupils do not want to be classified as males because of their close association with science, and also the fear that they might not be liked by boys if they appear good in science and technology (Schoenberg, 2004) also contributes to some females not participating in science. Other obstacles identified were poor performance in assessment tasks involving science and technology; limited experience to science and technology related extracurricular activities; little or no desire to pursue science or technology related careers in future (Clewell, Anderson & Thorpe, 1992; Rosser, 1990; Gatta & Trigg, 2001); de-motivating remarks made by male pupils to female pupils who were taking science and technology and who were performing well, as well as curriculum materials such as textbooks, diagrams which were biased against female pupils (Mulemwa, 2002; Welty & Puck, 2001).

One more issue which came to light as an obstacle to female pupils' participation in science and technology education is the belief that science and technology education are domains for boys only. This perception has been reported by researchers in various parts of Africa such as Sierra Leone (Amara, 1987); Kenya (Marangu, 1987); Uganda (Mulemwa, 1999a); Senegal (Kamara, 1987); Nigeria (Okebukola & Agholor, 1991) and Zanzibar (Nassor, 2001). This belief is also very prevalent among female pupils in Zambia (Mwase *et al.,* 1999). Because of this thinking, some female pupils avoid engaging in what is regarded as unacceptable by society and make efforts to conform to stereotypical social roles (Eccles et al., 1990). However, it is not known whether the few female pupils who join JETS club have contrary belief from those held by the majority of female pupils. Male pupils also think that they are the only ones who are supposed to be in the science and technology domain and do everything possible to keep away female pupils in this domain (Mwase *et al.,* 1999).

The factors identified above as having contributed to low participation of female pupils in SMT subjects also apply to the Zambian context (see e.g., Mwase *et al.,* 1999; Haambokoma, 2000; ZAWIST, 1998). Literature reviewed above has identified a number of factors which bring about low participation of female pupils in SMT subjects. However it is not known how the few female pupils who join SMT-based extra-curricular clubs such as JETS in Zambian schools experience these challenges and how they surmount them.

2.3 Females in Science, Technology, Engineering and Mathematics-based Fields

Although there are a number of factors which put off a large number of females from engaging in science, technology, engineering and mathematics (STEM)-based activities, as indicated in the previous section, there are, however, some females who are engaged in these fields. Studies have been undertaken to determine their personal traits, background, motives behind their entering these fields and their experiences in these careers which in a number of countries are dominated by men (Burke & Mattis, 2007; Harding & Apea, 1990; Besecke & Reilly, 2006; McGill & Woudenberg, 2012). The personal traits associated with some women in STEM careers were: hardworking during their school and tertiary level education in order to meet the required grades; persistence; determination to achieve what they wanted to accomplish even when it was against the wishes of some family members as well as ability to overcome obstacles (Reddy, 2001; Besecke & Reilly, 2006). They were also reported to have high aspirations such as desire for a special job, and also being high achievers in science, mathematics and technology compared to others (Erinosho, 2001a; Reddy, 2001; Blattel-Mink, 2002; Besecke & Reilly, 2006) as well as having interest in science and technology (Erinosho, 2001a). Some of these females have a less sex-type self-concept (Chatterjee & McCarry's 1991). They also have a tendency to be autonomous and emotionally stable and possess high intellectual and social confidence (Lobel, Agami-Rozenblat & Bempechat, 1993).

With regard to their background, most of these females were coming from a family environment that provided conditions which encourage and support desire to acquire qualifications and work in non-traditional careers for female (Blattel-Mink, 2002; Erinosho, 2001a; Dimitriadi, 2013; Lemkau, 1983). In some cases, their father or another member of the family were in a science and technology-based career (Blattel-Mink, 2002; Harding & Apea, 1990; Norby, 1997). Regular participation in school science clubs has also been associated with females in STEM careers (Erinosho, 2001a) as well as transforming experiences (Besecke & Reilly, 2006). In survey of women in science and technology-based careers, a good number of them reported that they were first born in their family (Harding & Apea, 1990).

From Harding and Apea's (1990) profile of some African women in STEM careers, the following emerged as reasons behind the females' decision to pursue STEM career: being good in mathematics at secondary school level; support and encouragement of their families. In this case, a good number of them cited their brothers as having been in science-based careers and acted as their role models while others cited encouragement and support from their brothers. Other reasons were supportive and encouraging teachers, in particular those teaching science; good performance in science subjects at secondary school; interest in science, meaning that they liked to learn science; desire to do something different from the rest and a belief that a woman can do any job even those perceived to be jobs for men such as engineering (Harding & Apea, 1990). High mathematical ability has also been cited by Mills (1997) and self-efficacy (Zeldin & Pajares, 2000) as important motivators in pursuing STEM careers by females.

In a study conducted in Swaziland to establish what attracted Swazi women into science and technology careers, it was also found that good performance in science and mathematics as well as enjoyment of science subjects were some of the motives which made females pursue careers in STEM. Other reasons cited, included problems sciences have brought to society; the belief that females can compete with males in science-based careers; the desire to change stereotype thinking that STEM careers are not for females as well as reading about science-related jobs (Dlamini & Nkosi, 2003).

Some of the challenges women in science, technology and engineering careers encountered were lack of encouragement from management even when work was done well (Wynarczyk & Renner, 2006), little support from their fellow women while men received a lot of support and encouragement from fellow men (Ronen & Pines, 2008). Lack of support from fellow women for women in STEM could be because some of them do not think that STEM careers are for women but for men. Therefore, they think there is no need for them to support people who do not respect the expectations of society. Another challenge experienced by females in STEM is the work-family conflict (Neal & Hammer, 2006; Harding & Apea, 1990). This is because in most cases, the nature of the job in a masculine typed career makes it very difficult for females to combine their job and family roles

(Gerdes, 1995; Besecke & Reilly, 2006). In Africa, women generally do more house chores compared to men, a situation which is not fair women.

Women in STEM career also experienced discouragement from peers at home who told them that jobs such as engineering were not for females, as well as from other school girls who were not in science classes who indicated that it was not normal for a girl to study science (Harding & Apea, 1990). Lack of support from male colleagues was also given as one of the challenges women experienced in a male-dominated career (Besecke & Reilly, 2006) because of being women. Females also experienced challenges to enter STEM careers dominated by men, and where they did, their works were scrutinised much more than that done by men. There were also instances when women were teased and distracted by men with the purpose of making them fail in the work they were doing (Harding & Apea, 1990). In some cases women also encountered discouragement from some science teachers while at secondary school who thought that science subjects were not for them. Challenges such as discrimination and harassment in their work places dominated by males have also been reported to have been experienced by some females working in the engineering field (Buse, Bilimoria & Perelli, 2013) .

Females used various ways to deal with some of the challenges they encountered as a result of their engagement in STEM careers. These are: to work extra hard to prove that one was as capable as men; ignoring the teasing and distraction from men and focusing on the work; demonstrating to males at both school and work place that they were as good as them (males) or even better; seeking support and help from other family members in terms of looking after children at home while they (females) were working and spending a lot of time with children during the weekend to compensate for their absence during the week (Harding & Apea, 1990).

Other coping strategies employed by women to counteract the challenges encountered during training were: developing a self-potential belief in STEM career; having study groups where females could discuss with others difficulties in various study areas; having a strong desire to succeed no matter what comes across; belief that a girl can learn and pass any subject, and forfeiting other activities to concentrate on studies (Dlamini & Nkosi, 2003).

Some women in the engineering field were reported to have persisted in this male dominated career despite the challenges they encountered for several reasons. First, they had high levels of self-efficacy and confidence which enabled them to manage challenging work circumstances and balancing work and home demands. Second, the decision to take up engineering career was their own, i.e., the decision was not influenced by anyone at all. Therefore, they liked being engineers. Third, they were good at science and mathematics at high school. This made it easier for them to deal with scientific and mathematical tasks easily in the course of performing their jobs. Fourth, continuous learning opportunities during the course of their work (Buse, Bilimora & Perelli, 2013).

The literature reviewed in this section gives some insight into possible personal characteristics of females who are in STEM activities like JETS Club. It also sheds some light into factors which might influence female pupils to join an STEM-based club like JETS in a school as well as challenges they may be encountering as members of JETS and how they deal with them. However, the information given in this section cannot be used to accurately answer the research questions of the current study because the sources of information were women working in STEM careers while the current study's target group are female pupils in JETS Club at secondary school level. Furthermore, the information reported in this section was obtained from respondents in Nigeria, Ghana, Kenya, Swaziland, South Africa and Zimbabwe, while the current study, is in Zambia. Another factor is that some of the information presented was collected many years ago. Thus, may not be applicable at present. In view of these differences, the reasons given above for pursuing STEM careers and the challenges they experienced as well as the coping strategies they used might not be applicable to female pupils in JETS Club in secondary schools in Zambia. Therefore it is still not known what influenced female pupils to join JETS Club and the challenges they were experiencing.

2. 4 Types of Science and Technology-based Extra- curricular Clubs in Schools

Extra-curricular activities are educational activities which pupils engage in out-side time-tabled lessons. Science and technology based extra-curricular activities take different forms. The commonest of these are science clubs. A science club is an out-of-school-hours club that gives pupils an opportunity to engage in science and technology-related activities as a means to supplement the science they learn during time-tabled science lessons. Science and technology-based extra-curricular clubs are found in schools in a number of countries worldwide such as the United States of America (Elizabeth, 2003; Molloy & Aronson, 2006; Stock, Hunt & Bronner-Fraser, 2002; Batts & Agarwala, 2008); Canada (Actua, 2008a, 2008b); Australia (Eastwell & Rennie, 2002, Woolnough, 2000); United Kingdom (Young Engineers, 2005; Watts, 1991; Harrison & Mannion, 1998; Mannion & Coldwell, 2008; Tosh, 2008; Wynarczyk & Hale, 2009); Netherlands (Moussa, 2000); Romania (Sporea & Sporea, 2006); Nigeria (Agholor & Okebukola, 1998; Duyilemi & Oluwatelure, 2012); India (Misra, Bhushan & Upadhyay, 2013); Serbia (Science in School, 2007) and Malawi (Nchesi, 2001), and many others. Science and technology based clubs also do exist in Zambian schools. One example is the JETS Club which is the focus of the present study. These science and technology-based extra-curricular clubs vary and have different purposes which are presented below:

2.4.1 Science and Technology-based Extra-curricular Clubs Intended to Engage Pupils in Experimental Work

Some of the science-based extra-curricular clubs are meant to provide opportunities to pupils to engage in practical work or scientific processes and through their engagement in processes such as observation, research, measuring, acquiring knowledge, skills and attitudes. Within this broad category, there are various kinds of clubs. One type of these clubs is meant to promote scientific and technological problem-solving for pupils, thereby complementing normal school work. Examples of such clubs are Australian science clubs (Eastwell & Rennie, 2002) as well as the CREST Club in Australia and the United Kingdom (Woolnough, 2000) and JETS clubs in Nigeria (Duyilemi & Oluwatelure, 2013). Another kind of club within this category is meant to build up scientific proficiency and creativity among pupils. For example, the Pupil Researcher Initiative (PRI) in the United Kingdom (Harrison & Mannion, 1998;Woolnough, 2000). Some of the clubs in this category are meant to provide opportunities to pupils to make presentations related to science and demonstration experiments outside time-tabled science lessons. They explore aspects of science not covered by the school science syllabus. For example, science clubs in Romanian schools (Sporea & Sporea, 2006) and science clubs in Indian schools (Misra, Bhushan & Upadhyay, 2013). Other extra-curricular clubs in this category are meant, amongst others, to provide opportunities to pupils to carry out experiments and acquire manipulative skills in science and technology outside time-tabled lessons. For example, the JETS in Nigeria (Agholor & Okebukola, 1998). Some of these clubs are for both male and female pupils. However it is not known how female pupils feature in these clubs. In Zambia, JETS also provides opportunities to pupils to conduct their own experiments. However, it is not known whether or not opportunities to perform experiments has an influence on some female pupils' decision to join JETS Club.

2.4.2 Science and Technology-based Extra- curricular Clubs Intended to Engage Pupils in Competitions

Some of the extra-curricular clubs are meant to give opportunities to pupils to compete among themselves within the school and between different schools. Within this broad category, there are different kinds of clubs. Some of the clubs involve pupils working on a project as a team for a period of one and half months. They are then given an opportunity to compete with pupils in other schools. Examples of such clubs are the Boosting Engineering, Science and Technology (BEST) and the Discovery Young Scientists Challenge (DYSC) in the United States of America (Elizabeth, 2003). Some clubs in this category involve engaging pupils in quiz contests between schools. In this regard, questions are prepared and are asked to contestants who are expected to respond within a given time. Scores are then added to determine a winning team. Examples of such clubs are the national chemistry quiz; Queensland school geology competition and biology Olympiads in Australia (Eastwell & Rennie, 2002) and the science clubs in Indian schools (Misra, *et al.,* 2013). JETS Club in Zambia also gives opportunity to female pupils to compete at school, regional and national levels. However, some scholars argue against the use of competitions. For example, Ekine and Abay (n.d.) are of the view that although competitions and quizzes are thrilling to spectators, they are not the most appropriate means for motivating female pupils who may have no confidence in science to participate in. Whether these competitions have negative or positive influences on a few female pupils who join JETS is not known.

2.4.3 Extra-curricular Clubs Intended to Promote Participation of Female Pupils in Science, Mathematics and Technology

The third type are extra-curricular clubs established to promote participation of female pupils in science and technology or aimed at recruiting more female pupils into SMT. Within this broad grouping, there are different types of clubs with varying activities. One type is intended to provide a secure and encouraging environment for girls in schools to engage in science and technology activities. For example, the TechREACH clubs in Western Washington (Molloy & Aronson, 2006). Another kind of club within this category provides education to high school female pupils in science and engineering topics not included in the high school curriculum, as well as provide role models for female pupils to motivate them go into science and engineering. The case in point, is the Double X Club in the United States of America (O'Sullivan & McGowan, 2003).

Some of the clubs provide experimental learning, mentorship and leadership opportunities to girls. These activities are intended to raise the self-confidence and science literacy of girls coming from groups that are under-represented in the sciences such as females. For example, the Science Club for Girls (SCFG) in the United States (O'Sullivan & McGowan, 2003). Another type of a girls' club links female pupils to persons, information and attitudes that will promote their connection with science at a time they make decisions in their life. The purpose is to keep female pupils engaged in scientific explorations. One example of such a club is the Sally Ride Science Club in the United States (Stock, Hunt & Bronner-Fraser, 2002). However, it is not known if at all these activities have had the intended effects on the girls.

Other clubs engage female pupils in high schools in activities intended to assist to prolong their interest in science, technology, engineering and mathematics. For example, the engineering clubs in rural American high schools (Batts & Agarwala, 2008). Some clubs engage female pupils in activities intended (among others) to improve their self-confidence and equip them with creativity and critical thinking skills in science, engineering and technology. They also bring into contact mentors and role models with female pupils in science, engineering and technology, for example, the Actua Programme in Canada (Actua, 2008b). Some clubs for girls organise activities intended to encourage, teach and sustain interest and self-confidence of female pupils in science, technology, engineering and mathematics. The clubs are run mainly by female pupils, who play a major role in determining the activities of the club and in the administration of it. An example of such a club is the Canadian Association for Girls in Science (Vingillis-Jaremko & Vingilis, 2004).

There are also clubs whose activities are intended to promote participation of both male and female pupils in SMT. For instance, the Young Engineers (Young Engineers, n.d.) as well as science and engineering Clubs in the United Kingdom (Mannion & Coldwell, 2008; Tosh, 2008). As indicated in chapter one, the JETS clubs in Zambian schools which are the focus of this study, have aspects of both providing opportunities for pupils to engage in practical work and to encourage competition among pupils. However, unlike other clubs established solely to promote female pupil participation in science, mathematics and technology, JETS caters for both female and male pupils.

As can be seen above, the examples of clubs given, are drawn mainly from outside Africa, specifically from North American and European countries because there was no documentation related to science clubs from African countries apart from Nigeria (Agholor, 1994; Agholor & Okebukola, 1998) and Malawi (Nchesi, 2001; Gray & Nchesi, 2004). This is one of the issues which made this study necessary. These examples are included in the review because they shed some light in understanding JETS Club in Zambia in relation to female participation.

2.5 Benefits of Participating in Science and Technology-based Extra-curricular Activities

Literature suggests that participation in science and technology-related extra-curricular activities is useful in terms of learning of science, mathematics and technology (Hartman & Glasgow, 2002; Jones,1997; Das, 2004; Furger, 2003; Commonwealth Secretariat, 1995; Reddy & Savage, 2004; Gray & Nchesi, 2004; Awortwi, 2007). One of the paybacks for participating in science and technology extra-curricular clubs cited by scholars is that they help to stimulate interest in science and technology among pupils (Jones,1997; Mulemwa, 1999; Molly & Aronson, 2006; Hartman & Glasgow, 2002; Thomas, 1986; Walton, n.d., Woolnough, 2000; Mannion & Coldwell, 2008; Clewell & Darke, 2000; Crane, Nicholson, Chen & Bitgood 1994; Fashola,1998; Nicholson, Weiss & Campbell, 1994; Agholor, 1994; Froschl, Sprung, Archer & Fancsali, 2004; Misra *et al.,* 2013). For example, Mulemwa (1999) asserts that science clubs can help pupils, in particular female ones, to like science education as well as maintain their interest in this area. Development of a positive effect on students' in particular female pupils, as result of involvement in extra-curricular science activities has also been reported (Sorge, Newsom & Hagerty, 2000). However, it is not clear how their participation in science based extra-curricular clubs resulted in a positive effect in their attitude. In India, the raised interest in science among science club participants was said to be due to awards given to the various science club (Misra, *et al.,* 2013)

Development of interest resulting from participating in extra-curricular activities has been reported to have had some carry-over effect to time-tabled lessons. In this regard, interest developed during participation in extra-curricular activities can in turn encourage groups of pupils who are not well represented in science such as female pupils to get into time-tabled science (Jones, 1997). Das (2004) cites instances where pupils who participated in science club activities became more interested in activities done during time-tabled science lessons. The benefit claimed above is based on science clubs from countries other than Zambia. However, whether or not this could be the same payback some female pupils who participate in JETS Club activities in Zambian schools derive is not known.

Participation in science and technology clubs in schools provide opportunities for cross pollination of scientific and technological ideas among pupils as well as providing opportunities to pupils to learn from each other (Commonwealth, 1995; Nchesi, 2001). This is so because during science and technology club meetings, pupils teach each other various topics as well as questioning each other. Furthermore, when they are working on projects, pupils get feedback from peers regarding their projects before they present them at fairs. The benefit claimed above is based on studies done in other parts of the world with different context other than Zambia. Therefore it is not known whether or not JETS clubs in Zambian schools provide opportunities to female pupils who join them to exchange ideas and also learn from each other.

Another benefit of science and technology-based clubs in schools advanced is that they help to improve both female and male pupils' understanding and knowledge of science and technology through the various activities they undertake (Agholor, 1994; Eastwell & Rennie, 2002; Awortwi, 2007; Mannion & Coldwell, 2008). Improved knowledge of science, engineering and mathematics careers has been cited as one of the paybacks for participating in after-school activities (Clewell & Darke, 2000; Crane, Nicholson, Chen & Bitgood 1994; Fashola, 1998; Nicholson, Weiss & Campbell, 1994; Misra, *et al.,* 2013). The benefit claimed above is based on participation in science and technology-related clubs existing in other countries other than Zambia. Thus, it is not known whether female pupils who join JETS Club in Zambia gain better understanding of science and technology.

Participation in science clubs activities such as research, hands-on and problem-solving activities is claimed to develop thinking skills such as creativity, critical thinking and scientific problem-solving among pupils (Awortwi, 2007; Reddy & Savage, 2004; Nchesi, 2001; Woolnough, 2000; Science in School, 2007). Regarding the same, Das (2004: 179) asserts that "science clubs provide an opportunity to pupils to express their creative abilities in the field of science and fosters development of new ideas". Furthermore, participation in science club resulted in stimulation of the spirit of curiosity, enquiry innovative and creatively. (Misra *et al.,* 2013). Participation in extra-curricular activities promotes creativity in pupils in the sense that their thinking is not limited to examinable material and also there is no examination pressure which may restrict their thinking. In addition, during fairs, participating pupils have a chance to see what other competitors have done and this can stimulate them to think further, that is, more creatively and critically than the way they may have been thinking (Reddy & Savage, 2004). Other skills and attitudes which female club members were reported to have developed as a result of participation in science club activities included curiosity, persistence, independence, inquisitiveness and ability to accept loss (Nchesi, 2001). Whether female pupils who participate in JETS Club activities in Zambia improve in their thinking skills as well as develop determination to accomplish a goal, independence and ability to manage loss as others claim above, are not known.

Science clubs also provide a good opportunity for pupils with different interests, abilities and skills to pursue their own interest in contrast to time-tabled science lessons since they have a chance to decide on a project they would like to pursue depending on their abilities and skills (Das, 2004) as well as interest. Science clubs also give pupils a chance to work on a project at their own pace as individuals, pairs or groups. Furthermore, they can provide a relaxed environment for learning which may not exist in many time-tabled lessons. In other words, pupils are more liberated than in a classroom setting (Das, 2004). This is because, in many cases, club meetings are conducted by fellow pupils who are members of the club. Therefore, they do not fear as they may do in the case of teachers. The other issue is that activities undertaken during club meetings are not examined at the end of the term or year. Hence, there is no fear of examination failure. However, it is not clear if the few female pupils who join JETS Club in Zambia are attracted into the club because they feel that JETS Club provides a relaxed learning environment for them.

It is also stated that participating in science-based extra-curricular activities promotes team-work among pupils (Science in School, 2007; Young Engineers, n.d.). This is because some of the activities in science clubs such as quizzes require that they do them in groups. In addition, when pupils visit another school for a competition, they consider themselves as a team and through this way, team-spirit develops. However, although participation in science club activities is said to promote team-work, it is not clear whether or not female and male pupils are able to work as a team in JETS Club activities in Zambia.

Furthermore, it is not known whether female pupils who participate in JETS Club activities develop team-spirit.

Science-based extra-curricular activities include designing and carrying out experiments of different types. These activities provide pupils with opportunities to acquire scientific behaviour of doing things. After observing pupils carry out experiments in a science club, Walton (n.d.) observed that it made the pupils to approach experiments in a way scientists conduct their experiments. For example, ensuring that the experiments were fair; having controls and the need to conduct an experiment more than once to ensure that the results are accurate as much as possible. Improved investigative skills have also been cited as positive outcomes of participation in extra-curricular activities by other scholars (see e.g. Clewell & Darke, 2000; Crane, Nicholson, Chen & Bitgood 1994; Fashola, 1998; Nicholson, Weiss & Campbell, 1994). However, it is not known whether or not female pupils acquire scientific investigative skills once they take up membership in science oriented clubs like JETS.

It is also said that science clubs also provide an opportunity to pupils to undertake advanced scientific investigations which they may not be able to do during time-tabled science lessons (Das, 2004) due to content and time restrictions. Another role science clubs are reported to play in schools is that they provide pupils with chance to examine aspects of science which are not part of the school science curriculum (Nchesi, 2001; Gray & Nchesi, 2004). Whether or not JETS Club in Zambian schools provides opportunities to conduct different exploration and study certain issues which are not part of time-tabled lessons, to the few female pupils who join, is not known.

Participation in science club activities contributes to improvement of pupils' confidence in science and technology (Awortwi, 2007; Molloy & Aronson, 2006; Walton, n.d.). On this , Awortwi (2007) claims that participation in science clubs removes the fear most pupils attach to science subjects, meaning that their self-confidence is improved. Improved confidence in science and technology as a result of engaging in extra-curricular activities has also been documented among Actua programme participants in Canada (Actua, 2008b), in England among participants of The After-School Science and Engineering Clubs

(Mannion & Coldwell, 2008) and among JETS Club participants in Nigeria (Agholor, 1994). Increased self-confidence in scientific capability because of engaging in extra-curricular tasks has also been reported by Clewell and Darke (2000), Crane, Nicholson, Chen and Bitgood (1994), Reid and Roberts (2006), Fashola (1998), as well as by Nicholson, Weiss and Campbell (1994). A similar claim with regard to enhancement of self-confidence has been made by Andres (2002) and Nchesi (2001).

There are several reasons why self-confidence increases in science and technology as a result of participation in club activities. These include: frequent engagement in scientific and technology-related activities; opportunities to explain to other people on their projects; opportunity to talk to other people, some of whom may be motivating to them after sharing their experiences (failures and success), particularly in cases where they turned failure into success. Other reasons include: the support and encouragement they receive from various individuals within and outside the club; interactions during meetings/fairs with other pupils with similar interests from other schools; successes they sometimes score in their activities within the club and seeing others (role models) do things they thought were difficult to do. These also contribute to the remove of fear of science from pupils.

The consequence of acquiring confidence in science and technology-related activities is that pupils will want to pursue science and technology subjects in schools. They are also more likely to choose SMT-based careers such as medicine and engineering and others. Although improved self-confidence has been cited by several scholars as one of the paybacks, it has not been proved whether this is the case for female pupils who participate in JETS in Zambian schools since the claims advanced above are based on information from different types of clubs in other countries, whose contexts are different from the Zambian one.

Engaging in extra-curricular activities also enables pupils to acquire good communication skills. Regarding this aspect, Walton (n.d.) reported that as a result of participating in science club activities, pupils acquired skills on how to articulate issues scientifically to various types of persons. Participation in project work is also associated with acquisition of both verbal and written communication skills (Heany, 1995). Development of both oral and written communication skills, and presentation skills has also been reported among participants of science and technology-based extra-curricular clubs (see e.g. Young Engineers, n.d.; Woolnough, 2000; Science in School, 2007; Nchesi, 2001). However, it is not clear which activities contribute to improvements in communication skills. Whether female pupils who participate in JETS Club activities in Zambia develop better communication skills as others have argued above is not known because this issue has not be investigated in Zambia.

Extra-curricular clubs may engage pupils in practical work which may not be possible during time-tabled lessons. Therefore, participation in clubs can provide chance to pupils to engage in practical work which may involve extending or consolidating what is done during time-tabled lessons. In some cases, pupils may engage in practical work which may be quite different from the one done during science lessons. For example, work done may be projects or tasks that have some connection to practical problems in the community (Mulemwa, 1999b). Through engaging in practical work during science and technology-based extra-curricular activities, pupils also develop practical skills. For instance, evaluation of The After-School Science and Engineering clubs revealed enhanced practical skills among members of the club (Mannion & Coldwell, 2008). However, it is not clear which skills are enhanced and how they are enhanced. An evaluation of participation in CREST practical activities found that pupils developed self-confidence in their ability to carry out practical work (Woolnough, 2000). Acquisition of practical skills have been also reported among pupils who participated in JETS Club practical activities in Nigeria (Agholor, 1994) as well as in Malawi among female pupils who participated in science club activities (Nchesi, 2001). However, it is not known whether or not JETS club activities in Zambian schools enable the few female pupils who join to acquire practical skills.

Another merit claimed is that participation in science and technology-based clubs contributes to promoting excellence in science and technology subjects among female pupils in formal lessons (Commonwealth Secretariat, 1995; Nchesi, 2001). For example, in connection with improved performance in examination, Nchesi (2001: 82) reports:

> For the first time in the school history, girls' performance during the primary school leaving certificate shows that they have done well. All girls who scored B grades in science participated in science club activities. Ten have been selected for Secondary Education. This shows that the club enhanced performance in their formal classroom science.

Good quality attainment in scientific subjects has also been reported by other researchers (see e.g., Crane, Nicholson, Chen & Bitgood 1994; Fashola, 1998; Chambers & Schreiber, 2004; Eccles *et al.,* 2003) as a positive result of engaging in extra-curricular activities. However, it is not known whether or not the attainment of female pupils who participate in JETS Club activities in Zambian has improved.

It is furthermore claimed that membership of science and technology-based extra-curricular activities does influence pupils to choose science-related subjects when given chance to do so at higher school levels. For example, Young Engineers (n.d.) reports that participation in Young Engineers Club influenced pupils' decisions to select science-related subjects when choosing the General Certificate of Secondary Education (GCSE) options as well as a career in England. Positive influences of participation in extra-curricular activities on science subject choice by advanced level students has also been reported by Woolnough (1994). Similar findings have been cited by (Woolnough, 2000) as well as by Actua (2008b) in Canada. The desire to continue studying science subjects or perseverance in the scientific field has been cited as one of the outcomes of engaging in science-related extra-curricular activities (Clewell & Darke, 2000; Nicholson, Weiss & Campbell, 1994). Inspiration to choose physics by some students at senior secondary and tertiary levels as a result of participation in science competition in Norway has been reported by Boe and Henriksen (2011). However, It is not known if female pupils who decide to join JETS Club in Zambia do so for the reason that they want to pursue science-related programmes after their secondary school education.

Participation in science club activities has been reported to facilitate formation of career aspirations in science or technology field. For example, Molloy and Aronson (2006) found that participation in TechREACH activities, particularly the exposure of girls to role models and careers in science, technology, engineering and mathematics, enhanced their thoughts about future science, technology, engineering and mathematics study and careers. Linder, Wingenbach, *et al.,* (2004) are also of the view that participation in extra-curricular activities by pupils may influence their view about career choice. Similarly, Woolnough (1994) found that involvement in science clubs and science competitions in England played a positive role in influencing students to pursue science and engineering in higher education institutions. Related effects have also been reported in Australia, Canada, China, Portugal and Japan (Woolnough, Guo, Leite, Ryu, Wang & Young, 1997). It has also been claimed that both female and male pupils developed a desire to pursue careers in science and engineering after participating in the After-School Science and Engineering Club in England (Mannion & Coldwell, 2008). Increased enrolment of female pupils in STEM Programmes at college level as a result of participation in an after school science programme at high school level has been reported by Fadigan and Hammerich, (2004). Whether participation in JETS Club activities by female pupils in Zambian schools has had similar influences as reported in studies given above is not known.

Involvement in extra-curricular science and technology activities has also been is said to improve awareness of careers available in science and technology fields among pupils (Eastwell & Rennie, 2002) as well as to have helped female pupils in Malawi identify their possible future profession (Nchesi, 2001). It is also claimed that participation in science-related extra-curricular activities helps pupils develop a self-directed work culture. This is because more responsibility is given to pupils in the science club to work on activities they like. For example, with respect to a project, they decide the kind of project they should embark on, type of materials they need in order to carry out their project, when to do the project and when they should complete the project. Therefore a pupil has to make decisions and supervise himself or herself in order to accomplish the task he or she gives herself or himself. This ownership also applies to other activities pupils engage in, in science clubs. On development of self-supervised work culture, Heaney (1995) observed that pupils who took part in project work acquired abilities to work on their own without being told what to do and when to do it. Similar sentiments have been expressed by others (see e.g., Science in School, 2007).

This section of literature review gives some insight into possible benefits of participating in science-based extra-curricular clubs. However, the information given above is based on science-oriented extra-curricular activities operating mainly in America and Europe which may not be applicable to the Zambian situation. Therefore, it is not known whether or not the few female pupils who join science based clubs such as JETS Club in Zambia experience the benefits cited.

Although there are various positive effects associated with participation in science and technology-related extra-curricular activities as revealed by literature reviewed above, there are also demerits related to participating in science and technology-based extra-curricular activities. For example, participation in extra-curricular science club activities may cause demoralisation if pupils meet challenging tasks, or results in loss of interest in science, technology and mathematics-related activities. Concerning this aspect, Eastwell and Rennie (2002) found that the difficult nature of some extra-curricular tasks de-motivated some pupils in Australia.

Another demerit is that some of the increases in pupils' interest reported by some researchers are short-term while some of the extra-curricular activities have no effect on interest and enjoyment of participating pupils, for example, the Biology Olympiads (Eastwell & Rennie, 2002). Furthermore, although some researchers have found that participation in extra-curricular activities results in improved attainment in assessment tasks, other researchers have not found a direct relationship between participation in extra-curricular activities and improved attainment. For instance, evaluation of a science-based extra-curricular programme called Mathematics, Engineering, Science Achievement (MESA) which offered among others, enrichment activities, revealed that the grades of 50% of the pupils who participated in the MESA programme had not improved (California Post Secondary Education Commission, 1996). However, the report does not specify the 50% in terms of females and male pupils. Similarly, evaluation of The Science and Engineering clubs, found that more than 50% of the club patrons and other teachers were not sure whether or not there was any change in pupils' attainment after participating in the club. Indeed, fewer than 5% did not agree that pupils were improving in achievement (Mannion & Coldwell, 2008).

In addition, the benefits which pupils can derive from belonging to an extra-curricular science club also depend, to a large extent, on the experience, interest and creativeness of the patron (Mulemwa, 1999b). A patron who is interested in a science club does a number of things to demonstrate this passion for the club. For example, he or she will talk to pupils about the club and encourage them to join by citing some of the possible benefits of being a member of the club; will also be available during most of the times club members are meeting to offer support, guidance and encouragement to the members. He or she makes club members feel successful. The patron knows club members well and calls them by their names. Whenever club members need something, the patron ensures that their need is met. He or she is approachable to all club members. As a result of the interest the patron shows in science club, pupils also develop interest in club activities. With respect to this aspect, scholars (e.g. Sharpe, 2004; Krogh & Thomsen, 2005) argue that girls are motivated and show interest when a teacher is encouraging them and helpful. Furthermore, if the patron is resourceful, pupils belonging to such a club can benefit a lot. However, if the reverse is the case, they are unlikely to benefit. In connection with this issue, Bouffard and Little (2004) state that good quality extra- curricular experiences for female pupils depend upon good quality staff. Whether these could be similar challenges some female pupils who join JETS Club in Zambian schools experience is not known.

2.6 Studies Related to Influences on Pupils/students Choices of Science, Mathematics and Technology subjects/activities

Studies have be conducted in different parts of the world aimed at understanding motives behind pupils' and students' decisions or choices to enrol in SMT related subjects, careers and extra-curricular activities (e.g., Lyons, 2004; Barnes, McInerney & Marsh, 2005; Smart & Rahman, 2009; Walkington, 1998; Boe & Henriksen, 2011).

One factor which emerged from some of these studies as having an influence on pupils' or students' enrolment decision in SMT-related subjects is self-efficacy or one's ability belief (Lyons, 1998; Cleaves, 2005; Smart & Rahman, 2009; Liston, Peterson & Ragan, 2009; Rennie & Punch, 1991; Rodeiro, 2007). Self-efficacy is self-perception or one's ability belief. Self-efficacy can be low or high. A pupil who has low self-efficacy or ability belief is one who thinks that he or she cannot do or learn a given task or succeed in a given area. On the other hand, a pupil who has a high self-efficacy is one who perceives himself or herself that he or she has the ability to do/learn/succeed in a given task or subject. Low self-efficacy is equivalent to low self-confidence while high self-efficacy, is equated to high self-confidence. In this case, pupils/students were of the belief that they had the necessary intellectual ability to engage in SMT activities which were perceived to be challenging. Usefulness of the subject or activity has also been cited as one of the influences on pupils' decision to enrol in SMT-related subjects in different studies (Lyons, 2004; Barnes, McInerney & Marsh, 2005; Walkington, 1998; Erinosho, 2001; Chimwayange & Davies, 2004; Rodeiro, 2007).

Usefulness refers to how a specific thing e.g. subject or activity can be of help to a person to achieve his or her future ambitions. For example, one's ambition could be to pursue training as a medical doctor after secondary education. Therefore to prepare adequately for the study of the human body during training as a medical doctor, one will opt to study biology at secondary school level because he or she considers it as useful or helpful in providing the necessary pre-requisite knowledge for pursuing a medical degree. Usefulness can also be seen in terms of assisting an individual into gaining entry in a programme of study in future. For example, if one has intentions of entering the engineering programme at university level, two of the most useful subjects to study would be mathematics and physics because they (in most cases) are considered as required subjects for admission into the engineering programme. Thus, a useful activity or subject is regarded as a 'stepping stone' into something one aspires to be or do. In all the studies reviewed, usefulness was considered in terms of future career intentions or career choices after secondary education (Smarts & Rahman, 2009; Chimwayange & Davies, 2004; Wan, 2006; Rodeiro, 2007) and for admission into colleges and universities (Boe & Henriksen, 2011).

Another factor identified as having had an influence on pupils' decisions to enrol for a subject is interest (Smart & Rahman, 2009; Walkington, 1998; Tsagala & Kordaki, n.d.; Liston, Peterson & Ragan, 2009; Boe & Henriksen, 2011; Tajmel and Hadzibegovic, n.d.; Chimwayange & Davies, 2004; Rodeiro, 2007). Interest is used here to mean liking something. If someone has an interest in a subject, it means that he or she likes that subject or activity. People who have an interest in something e.g., subject or activity also enjoy engaging in that activity or learning the subject. If someone has an interest in something, he or she will pay particular attention to it, always wanting to be associated with it and participate in it. Thus, when given chance to select a subject, pupils will choose the one they are interested in. Whether or not one's ability belief, interest and/or usefulness of JETS Club are some of the influences on female pupils' decision to join this club in Zambia, is not known.

The perceived high-status of science subjects was also found to have influenced the enrolment decision of some pupils (Lyons, 2004; Cleaves, 2005). Something is considered as of high-status when it is associated with a special group of people such as rich or intelligent ones. It could also be something which is very expensive or a subject which is difficult. In schools, science subjects are generally perceived as high-status subjects because they are a gate way to some of the prestigious professions, such as engineering or medicine. They are also regarded as prestigious because they are considered to be intellectually demanding and therefore perceived to be appropriate for intelligent pupils. Whether the status of JETS Club in the schools could have influenced some of the female pupils to join JETS Club is however not known.

The family was also found to have had an influence on pupils' decisions to enrol for certain science subjects by several researchers (e. g. Lyons, 2004; Liston, Peterson & Ragan, 2009; Henriksen, Angell & Lavonen, 2004; Bourdieu & Passeron, 1990; Dlamini, Ngwenya & Dlamini, 2004; Wan, 2006). Family is used here to mean a social unit which comprises father, mother and children. These elements comprise family members. Family members influence pupils' decisions to enrol in science subjects in different ways. For example, through demonstrating interest in science, through talking about it, providing help to pupils when they are doing projects, motivating and making available scientific materials to their children (Lyons, 2004). Some studies found that among family members, fathers were more influential than other family members (Liston, Peterson & Ragan, 2009; Boe & Henriksen, 2011; Adya & Kaiser, 2005; McHale et al., 1999) perhaps because of the authority they held in the family. On the other hand, the mother's influence was found to be not important (Adya & Kaiser, 2005). Whether or not family members may have influenced some of the female pupils to join JETS Club in Zambia is not known.

Another source of influence on pupils' or students' enrolment decision identified by researchers were teachers (Walkington, 1998; Tajmel & Hadzibegovic, n.d.; Wan, 2006). Term teacher is used here to mean a person who conducts science lessons in a school for purposes of facilitating learning. It is reported that teachers influenced pupils in different ways. For example, some of the teachers were said to have influenced pupils' enrolment decisions through advice they gave to pupils (Welty & Puck, 2001) while others inspired pupils' decisions through presenting their lessons well (Wan, 2006). Some studies found that friends also played a role in influencing pupils' subject enrolment decisions (Henriksen, Angell, Lavonen & Ines, 2004; Dlamini, Ngwenya & Dlamini, 2004; Welty & Puck, 2001). The term 'friend' is used to mean peers or close associates. These could be people who they were with at the same school or at home. Friends with interest in science subjects influence decisions to enrol in a subject in a variety of ways, such as by expressing their interest in the subject and by talking about the benefits of studying the subject. It is not known whether or not teachers and friends also motivated some of the female pupils to join JETS Club.

Role models were also reported to have influenced pupils' decision to enrol in certain subjects (Chimwayange & Davies, 2004; Wan, 2006). Role model is used here to mean successful individuals in a science-based field worth imitating. Role models influence pupils' decisions to choose science subjects by creating a thinking in them that they can also succeed as they (role models) succeeded (Bandura, 1986). Role models influence decisions through sharing issues behind their success in their fields. Thus, they enhance pupils' self-esteem and motivation (Healy, 1990; Hill *et al.,* 1990).). Role models have also been said to be important with respect to choice of non-traditional careers by females (Quimby and Desantis, 2006). However, it has been observed that role models do not help directly in decisions to choose a career (Dimitridi, 2013). For example meeting a very good science teacher does not mean that the girl will also choose to be a science teacher.

The media were also reported to have influenced pupils' decisions to take certain subjects (Henriksen, Angell, Lavonen & Ines, n.d.; Boe & Henriksen, 2011). Media are used in this study to mean both print (such as newspapers and textbooks) and electronic media (such as television and documentaries). Furthermore, high marks in past examinations in certain subjects influenced some pupils and students to enrol in related subjects at higher education level (Tajmel & Hadzibegovic, n.d.). If one scored very good grades in science subjects at the end of his or her secondary education, she or he will be inclined to choose to study science subjects at university level. This is because pupils think they can still do well at higher levels in these subjects.

Another factor reported as having made some pupils decide to enrol in a science subject is the desire by female pupils to show that they were intellectually as good as boys who decided to study science (Baker & Leary, 1995; Wan, 2006) in line with the view held by liberal feminists (Sinnes, 2005). This counteracts a commonly held perception that female pupils are not as intelligent as male pupils. The school system was also reported to have influenced female pupils' enrolment decision into design and technology (Dlamini, Ngwenya & Dlamini, 2004). In this regard, the female pupils were told by the school management to enrol into design and technology because it was felt that they needed to take this subject. This approach is also commonly used in Zambian schools where subject combination for pupils is decided by the school management. Whether or not role models, past performance in examinations, the media, desire for gender equality are among some of the influences on female pupils' decision to join JETS Club in Zambia is not known.

Studies reviewed above are relevant to the current study in that they focus on identifying factors which influence pupils' and students' decisions to enrol in science-related subjects. Thus, they provide some insight in understanding data from the current study. Furthermore, some of the studies involve female pupils at high school or senior secondary school levels. Thus, these are appropriate to the current study which focuses on female pupils who are more less at the same educational level.

However, these studies are also limited in relation to the current study in a number of ways. One limitation is that they were conducted outside Zambia, mainly in North America, Europe, Asia and Australia, which are contextually different from Zambia. It is therefore not clear if at all the reported influences on decisions would apply to female pupils' decision to enrol in JETS Club in Zambia with different contextual conditions. The female pupils who participated in the studies reviewed have different social backgrounds, priorities and aspirations from those of the Zambian female pupils in the current study. Furthermore, the female pupils in the studies reviewed come from different educational systems in comparison to the female pupils in the current study. Another limitation is that in some of these studies reviewed, respondents were both male and female pupils. Thus, the findings reported may not apply accurately to the current study involving female pupils only. In addition, the decisions or choices investigated in most of the studies reviewed in this section involved enrolment in science subjects which are part of the core-curriculum in most schools. Therefore, the findings may not be very applicable to decisions involving enrolment in extra-curricular science-based clubs like JETS. Finally, the studies reviewed are also limited in the sense that most of them did not give insights into how the various factors identified influenced pupils' enrolment decisions. For example, those that found siblings as being influential, they were not clear as to whether brothers or sisters were more influential on their enrolment decision and how they influenced them.

A related study conducted in Zambia found that female pupils' decisions to take science subjects at senior secondary level was influenced by teachers, family members, performance in science subjects in the previous examination (Kambikambi, Mungomba & Jain,1998). The same study also established that some female pupils took sciences because they were told by the school to register for sciences. This study is closely related to the current study in that it was done in Zambia and therefore the context is similar to the present study. Furthermore, the fact that the respondents in the reviewed study were female pupils only at senior secondary school level, makes it more relevant to the current study. Thus, it gives some insights on possible influences on female pupils' decision to join JETS Club. However, the study has limitations in that it investigated influences on female pupils' decisions to study sciences not to join JETS Club. Therefore it is not known whether or not the few female pupils who join SMT based clubs such as JETS are influenced by teachers, family members and past performance in assessment tasks.

Some studies have investigated influences on decisions to participate in extra-curricular activities. One of these studies by OLszewski-Kubilius and Yasumoto (1994) found that high-achieving middle school pupils decided to participate in an extra-curricular activity because of interest, intellectual capability, past learning encounters and the value parents attached on science. The relevance of Olszewski-Kubilius and Yasumoto's study in relation to the current study is that it examined influences on pupils' decisions to participate in an after-school science-based activity. However, it is limited in the sense that it was done somewhere in a context different from the Zambian one, and therefore the findings from this study cannot be taken to be the ones which influence female pupils to join JETS Club in Zambia. Furthermore, the respondents were not female pupils only. Therefore, it is not known whether or not some of the female pupils who decided to join JETS Club in Zambian schools were influenced by interest, intellectual capability and parents as established by Olszewski-kubilius and Yasumoto (1994).

Another study undertaken in America to find out what made school children ranging from 9 to 19 years old engage in different after-school activities, found that one reason children decided to join these extra-curricular activities is that they were of the view that they were exciting and therefore wanted to be part of this excitement. The second reason was that they wanted to develop skills. However, it is not clear which skills these are. Third, they wanted to be in the company of friends and patrons of these activities. Other influences emerging from the same study but not frequently mentioned were encouragements from elderly people and future aspirations (Mahoney, Harris & Eccles, 2006). Nevertheless, it is not clear what kind of elderly people these were, that is whether they were members of the family, non-family members or people in the school. Similarly, it is not clear what future aspirations these were

Although the findings above may help to shed some light on what would have influenced some female pupils to join JETS Club in Zambian schools, it has limitations. First limitation is that the study was conducted in schools in the United States of America whose context is different from that in the Zambian schools. The second limitation is that the sex of participants is not known. It could be that data were collected from both female and male pupils, which in this case, the findings may not apply to female pupils only who are the participants in the current study. The third limitation is that the study by Mahoney, Harris and Eccles (2006) investigated reasons for the youths' participation in different types of organised out-of-school activities in America and therefore the findings may not be generalised to female pupils' decision to join JETS Club in Zambian schools. The fourth limitation is that the study used individual interviews as one of the methods of collecting data which may have been threatening to some participants. In view of limitations presented above, it is not known whether or not female pupils who decided to join JETS Club in Zambian schools were influenced by factors identified by Mahoney, Harris and Eccles (2006) namely, exciting, desire to develop skills, desire to be with friends, encouragement by other people and future plans.

Encouragement from some members of the family, opportunity for assistance on academic work for purposes of achieving success, other opportunities available by venture of being a club member were reported by Ferrari and Turner (2006) as having motivated youths to join and continue to be members of an after-school programme in the United States of America. The results of Ferrari and Turner's study provide some clue to understanding what could have possibly made some female pupils in Zambia to decide to join JETS Club. This is because some of the participants in the study reported above were female pupils and the programme involved was an extra-curricular one just like JETS Club is. However, the findings are limited in the sense that the study was done in the USA, which again is culturally and socially different from Zambia in which JETS Club is found. Furthermore, the study reported involved a small sample comprising five female and two male pupils of African-American origin. Therefore, the findings may not be generalised to other situations like the Zambian one. In addition, the after-school programme involved in the study was not a science club similar to JETS. Thus the findings of Ferrari and Turner's study cannot be generalised to decision involving joining JETS Club by female pupils only in Zambia.

A similar investigation to the current study involving female pupils in JETS Club was conducted in Nigeria by Agholor and Okebukola (1998). The study reported a number of influences as having motivated female pupils to join JETS Club. One of these influences identified was the award given to the best female participant in the JETS Club during the annual National JETS competition. Another influence was the advertising done on national radio and television in Nigeria, throughout the year about the JETS Club competition. Other two influences reported were the various activities (such as quizzes, extended investigations and competitions) done in the club as well as tours to other schools and sites made by members of JETS Club (Agholor & Okebukola, 1998). This study is closely related to the current study in the sense that it targeted female pupils in Nigeria, located in Africa, and it investigated influences on the female pupils' decision to join JETS clubs. Consequently the findings help to some extent to shed light on possible influences on female pupils' decision to join JETS Club in Zambia. However, it is limited in that the study was done in West Africa, in Nigeria. Although Nigeria is an African country just like Zambia, the social environment from which respondents came from, is different from the Zambian social and educational contexts. Therefore the findings of Agholor and Okebukola's study cannot be generalised with a lot of confidence to explain factors which might have influenced some female pupils to decide to join JETS Club in Zambian secondary schools. This limitation made the current study necessary in Zambia.

The review of literature presented in this chapter sheds some light on possible influences on decisions pupils make with respect to subjects and extra-curricular activities. However, it has shown that there are a number of knowledge gaps with respect to factors which might have influenced female pupils' decisions to join JETS Club in Zambian schools as well as paybacks and challenges of being JETS Club members. Thus the current study is necessary to address these knowledge gaps.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Qualitative Research Design

In the current study, the researcher used qualitative research design and group interview as the method of collecting data from female pupils in order to answer the research questions. There is no commonly agreed definition of what a qualitative research is (Best & Kahn, 2006; Creswell, 2007). However, it has a number of characteristics used to describe it (Bryman & Burgess, 1999; Creswell, 2007). These are that it takes place in a natural setting (Borg & Gall, 1989; Creswell, 2003; Merriam, 1998). In other words, qualitative research requires that the researcher goes to the site where the people to be studied are to observe them or talk to them (Merriam, 1998; Creswell, 2007); it aims at comprehending the phenomenon being investigated from the point of view of those being investigated, and not from the investigator (Bell, 1999; Kombo & Tromp, 2006; Woods, 2006). The main goal of qualitative approach is to seek deep understanding of the issue being investigated, not to generalise the findings (Crouch & Mckenzie, 2006; Ulin, Robinson & Tolly, 2004; Wallen & Fraenkel, 2001). The main research tool for gathering data in a qualitative study is the investigator (Borg & Gall 1989; Merriam, 1998).

Other characteristics of qualitative research are that it uses mainly interactive methods of collecting data, such as observations and one-to-one or group interviews, which give opportunities to the researcher and participants to interact (Borg & Gall, 1989; Creswell, 2003). The study sample is usually small compared to quantitative research sample (Mason, 2010; Wallen & Fraenkel, 2001) and in most cases selection is by means of non-probability sampling procedure (Merriam, 1998; Neuman, 2003) such as purposive sampling (Borg & Gall, 1989). It has a flexible and emergent research plan (Wallen & Fraenkel, 2001), meaning that as the investigation proceeds, the plan can be changed allowing the researcher to accommodate changes during the course of the study (Creswell, 2003; Punch, 2007; Silverman, 2005). The outcome of qualitative research are data in form of words, used to communicate the understanding of the phenomena the investigator has acquired (Merriam, 1998; Wallen & Fraenkel, 2001). The interpretation of data is made by the researcher and it attempts to understand many realities not just one (Lincoln & Guba, 1985). Furthermore, reporting of qualitative research contains quotations of participant's utterances to support findings (Merriam, 1998; Neuman, 2003). Analysis of data in qualitative research begins during data collection phase and continues until all data have been analysed (Rabiee, 2004; Wallen and Fraenkel, 2001; Woods, 2006).

Philosophically, qualitative research is located within the interpretivism paradigm (Denscombe, 2007; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 1998). There are various meanings attached to the term 'paradigm' which have been advanced by various scholars (Creswell, 2007). In this study, the term 'paradigm' was used to mean a set of assumptions or beliefs about the nature of social reality or truth (i.e., ontology) (Blaikie, 2000) and nature of knowledge as well as processes of acquiring knowledge of social reality (Blaikie, 2000) which, in other words, is referred to as epistemology. Thus, a paradigm can be described as an ontological and epistemological basis of a research process. It gives direction to the research process (Guba & Lincoln, 1994). The interpretivism paradigm emerged, as a critique of positivism in the social sciences (Cohen & Crabtree, 2006). The interpretivists ontological belief is that there is no single 'social reality' or 'truth' but many realities about every problem that form the topic of study (TavakoI & Zeinaloo, 2004; Mack, 2010; Kim, 2003), and that reality is socially constructed (Lincoln & Guba, 2000; Krauss, 2005; Mutch, 2005). People make their own sense of reality (Wellington, 2000). Therefore, social reality is subjective (Krauss, 2005) and multiple. On the nature of knowledge and ways of acquiring knowledge (epistemology), interpretivists believe that knowledge is acquired through personal experiences (Mack, 2010) and involves contacts between the researcher and the researched so as to acquire an inside view of those being researched.

3. 2 Rationale for Choice of Qualitative Approach

Qualitative research approach has some challenges as a method of investigation, such as cost (Kim, 2003), time-consuming with respect to data collection, transcribing and analysing data (Mason, 2010). Others challenges are that information generated may not be applicable to other female pupils who did not participate in the study or are in different schools (Johnson & Onwuegbuzie, 2004; Kim, 2003) as well as researcher bias (Kim, 2003). However, despite the challenges cited above, qualitative approach was used to address the research problem because of certain factors considered.

First, was the flexibility nature of the qualitative design (Creswell, 2003; Merriam, 1988; Merriam, 1998; Punch, 2007; Picciano, 2004; Silverman, 2005; Wallen & Fraenkel, 2001). The flexible design was appropriate because during the course of this study, several changes to the initial research design were made. For example, initially, it was planned that the study would be conducted in the Southern province. However during the course of the study, it was changed to Lusaka province. Initially, the study was to be conducted in eight schools in Southern province but this was changed to four schools in Lusaka province. Again the initial plan was to interview two female pupils using a one-to-one interview approach at each of the eight schools, but this was changed to interviewing 12 female pupils at each of the four schools using group interview. The interview questions were also changed, because some of them were not very clear to participants. In some cases, it was felt that it was not appropriate to ask certain questions because of the nature of the school in which pupils were. Furthermore, after the initial analysis of data provided by female pupils, a decision was made to corroborate the data from female pupils with data from teachers. So the researcher attended the 2010 Zambian National JETS fair at which he talked to various categories of teachers who had been working with girls in JETS Club. These extra sources of data were not in the initial plan.

Second, the field work aspect of qualitative approach would allow the researcher to conduct the study in the natural setting. In this study, 'natural setting' was taken to operationally mean in schools where JETS clubs were located and where most activities took place.

Third, the interactive nature of qualitative approach was another motive. The information relating to influences on some female pupils decisions to join JETS Club could be better gathered by talking directly to female pupils involved than having them complete a questionnaire. In line with this view, Sinnes (2005) argues that information regarding people's views and thoughts can better be obtained through talking and engaging with the person instead of making him or her fill in a predefined questionnaire. Therefore, this approach would allow the researcher to talk to female pupils since it is interactive (Creswell, 2003).

Fourth, the aspect of qualitative approach giving good understanding of the issue being investigated was another compelling reason for using it. The major purpose of undertaking this study was to acquire a deep understanding of influences on female pupils decisions to join JETS Club not necessarily to generalise to a wider population. Thus, a qualitative approach would make it possible to acquire a more comprehensive understanding of the issue under investigation (Farzanfar, 2005) in comparison to quantitative approach (Silverman, 2000), which is mainly concerned with generalisation of findings to a wider population.

Fifth, research questions were used to guide the research process in the current study instead of hypotheses or objectives. Because of this, a qualitative approach was used. Creswell (2003) posits that for a qualitative study, only questions are appropriate. Further - more, the type of research questions which had to be answered was another reason for using a qualitative approach. According to Tavakoi and Zeinaloo (2004), one important criterion for deciding whether to use a quantitative or qualitative approach is the type of question the study is intended to answer. Johnson and Onwueghuzie (2004: 17) also collaborates that in carrying out a study, "what is most fundamental are the research questions. Research methods should follow research questions in a way that offers the best chance to obtain useful answers". A similar argument has also been advanced by other scholars (see e.g. de Vaus, 2001; Lederman, 1992; Mason, 2002; Sosulski & Lawrence, 2008).

Sixth, the qualitative approach allows commencement of data analysis as soon as some data is collected instead of waiting until all the data is collected. Since the researcher wanted to start data analysis as soon as he finished collecting data at the first school, qualitative data was seen to be more appropriate for this purpose.

Qualitative approach has also been used by other researchers before, who have conducted similar studies to the current study on adolescents' choice and decision-making (see e.g., Fredricks, Alfeld-liro, Hruda, Eccles, Patrick & Ryan, 2002; Ferrari & Turner, 2006).

3.3 Research Sites

The study was conducted in Lusaka region of Zambia. Lusaka was purposively selected as a research site because it was considered to be more convenient for the researcher to visit the participating schools easily and several times (if need be) during data collection phase, since the researcher was based in Lusaka. Furthermore, Lusaka region was also appropriate for the study because it had different kinds of schools such as rural, urban, single sex, mixed sex, government and grant-aided, which made it possible for the researcher to select schools with different characteristics and, therefore to capture a variety of views from participants in different contexts. Within the Lusaka region, the study was conducted at one secondary school (a school which has grades 8 to 12 classes) and three high schools (schools which had only grades 10 to 12 classes) bringing the total number of research sites to four. In the present study, these schools were operationally called Antelope High School, Buffalo Secondary School, Duiker High School and Eland High School. The characteristics of each of these schools are given in Table 3. These schools were purposively sampled after consultations with the JETS Secretary and the Ministry of Education Standards Officer for sciences in Lusaka province.

Purposive sampling is a non-random sampling procedure used to choose research sites or individuals who a researcher thinks are likely to have information needed to answer the research questions (Cohen & Manion, 1994; Cohen, Manion & Morrison, 2007; Wallen & Fraenkel, 2001; Maree & Pietersen, 2007) and would be willing to share them with other people (Kumar, 1996). In this study, the purposive sampling method was used to select schools so as to access schools which would assist the researcher to address the research problem being investigated (Creswell, 2003; Neuman, 2003). In a qualitative study, research sites are normally selected using purposive sampling (Wallen & Fraenkel, 2001). The following criteria were used to select the four schools which participated in the study: (1) school with an active JETS Club; (2) school with female pupils; and (3) willingness to participate in the study by the school. The reasons for collecting data from four different schools were to get different perspectives and also to deepen the researcher's understanding of the issues being investigated. Variety increases the range of responses that might contribute to full comprehension of the phenomena under investigation (Krefting, 1991). The multi-site and multi-source approach was also intended to enhance the credibility of findings (Borg & Gall, 1989; Best & Kahn, 2006; Krefting, 1991).

3.4 Study Population

The study population was all grades 10, 11 and 12 female pupils who were members of JETS Club. The female pupils in grades 10, 11 and 12 were chosen as the study population because pupils in these grades had been in school longer than grades eight and nine pupils. Since they had been in school longer and they had longer experience in JETS Club, they would be in a better position to respond freely to questions posed to them, soliciting for their views with respect to the research questions of the current study. Furthermore, they had more information to share than grades eight and nine pupils regarding the issue being investigated. In a qualitative study, it is recommended that efforts should be made to pick participants who are knowledgeable in the issue being investigated (Kombo and Tromp, 2006; Creswell, 2007).

3.5 Sample and Sampling Procedure

Since all members of the target population at each of the four schools could not participate in the study, a few female pupils from the study population were selected. Thus, at each of the four participating schools, 12 female pupils who were members of JETS Club participated in the study. Therefore, a total of 48 female pupils from the four schools participated in the study. There is no clear recommended adequate sample size in a qualitative research (Mason, 2010), as it depends on the purpose of the study. In the current study, a sample of 48 pupil participants from four different schools, was an appropriate sample size for the purpose of this qualitative study. Normally, in a qualitative study, the sample size is small (Merriam, 1998) because the number of times a particular response is given is not always necessary (Mason, 2010). The sample given above would give different perspectives and rich accounts to answer the research questions.

Table 3 shows the characteristics of schools and names of female pupils who participated in group interviews at each of the four schools. For purposes of confidentiality, the names of pupils used are fictitious. Scholars (e.g. Creswell, 2003; Borg & Gall, 1989) recommend use of fictitious names as an appropriate way of maintaining confidentiality of participants.

Table 5: Characteristics of Schools and Names of Female Pupils who Participated in Group Interviews

Names and characteristics of schools	Female pupils who participated in group interview
Antelope High School: Urban; Mixed sex; Boarding; National and Government	Angela; Betty; Cecilia; Dorothy; Eunice; Fridah; Gloria; Harriet; Ireen; Lucia; Mirriam and Nancy.
Buffalo Secondary School: Rural; Single sex; Boarding and Mission	Agnes; Beatrice; Celina; Daisy; Elinah; Florence; Grace; Rachel; Isabel; Mary; Naomi and Patricia
Duiker High School: Urban; Mixed sex; Non-boarding and Government	Agatha; Bernadette; Catherine; Doreen; Ellen; Francisca; Getrude; Hellen; Idah; Juliet; loveness and Maureen
Eland High School: Urban; Single sex; Non-boarding and Government	Albertina; Bertha; Cynthia; Dorcus; Ethel; Felistus; Grenda; Hilda; Inutu; Lilian; Olipah and Sandra

Source: Field data

The majority of participants were in grade 12. More grade 12 pupils were required in the current study because they had been in school and in JETS Club longer than the rest of pupils. See Appendix **A** for more details regarding the characteristics of the participants above.

When selecting participants for the current study, the desire was to pick those who had the required data to answer the research questions as well as to collect the needed data within a short duration. Purposive sampling met these conditions (Wallen & Fraenkel, 2001). Thus, female pupil participants were selected using purposive sampling at each of the four participating schools. Purposive sampling enabled the researcher to access those female pupils who had in-depth information and experiences regarding influences on their decision to join JETS Club. Purposive sampling has also been recommended as the most appropriate method for selecting participants when one is using a qualitative approach by other scholars (see e.g., Denscombe, 2007; Kuzel, 1992; Patton; 1990; Sarantakos, 2005; Tong, Sainsburg & Craig, 2007) because it enables one to select cases that are rich in the required information.

However, the researcher was aware that the purposive method of selecting participants had a weakness. That is, in some cases, a researcher may make a mistake when picking the participants because of lack of adequate knowledge of participants (Wallen & Fraenkel, 2001). Therefore, in order to ensure that the female pupils selected were the ones who could provide the required data to answer the research question, JETS Club patrons who knew female pupils in JETS Club well, helped the researcher in the selection of female pupils for study at each school. Seeking help from other people when selecting participants purposively has been recommended by researchers (see e.g. Tongco, 2007) and also used by other researchers (see e.g., Bah, Dialio, Demb'el'e & Paulsen, 2006).

3.6 Research Instruments

A self-completion questionnaire was used to collect background data from participating female pupils because it was the most appropriate one for collecting background information of participants**.** For details regarding this questionnaire, see Appendix **B.** However, some of the participants were not able to respond to certain aspects of the questionnaire because they did not have the information while others felt uncomfortable to do so.

An interview guide was used to collect data from female pupils. The interview guide consisted of an introduction, a list of open-ended questions related to the issue under study (asked during the interview) and a conclusion. For details of the interview guide, see Appendix **C.** Although open-ended questions take a longer time to analyse and are more difficult to analyse compared to closed questions (Stewart & Shamdasani , 1990; Bryman, 2001; Sarantakos, 2005), they were the most appropriate to use because they would generate detailed data as they allow the respondents to express themselves freely without restrictions (Kumar, 1996; Bryman, 2001). This view is also supported by Litosseliti (2003:

63) who argues that open-ended questions "allow people considerable freedom to choose what to say, how much, and how to say it."

3.7 Validation of Research Instruments and Pilot study

A number of steps were taken to ensure that research instruments collected data they were expected to collect. This was done by subjecting initial drafts of the research instruments to critical peers/colleagues. They were requested to critically analyse and evaluate the suitability of instruments for the intended purpose, by examining the question content, question wording, question length, relevance of questions to the study, logical sequencing of items and the formats. The instruments were revised in light of the suggestions given. Best and Kahn (2006) advise that review of instruments by colleagues and experts in the area of investigation may expose vagueness that can be done away with or changed. This in turn improves the quality and validity of the instrument.

Furthermore, before the main study was undertaken, a pilot study was conducted. The researcher considered a pilot study being important to undertake because of its usefulness (Bryman, 2001; Bell, 2002). The pilot study was undertaken in June 2010 at one school in the Lusaka region, with similar characteristics to schools and female pupils who were to participate in the main study. The use of a school and pupils with similar characteristics to schools and participants which were used in the main study was in accordance with the recommendations of Borg and Gall (1989), Gay (1996), Litosseliti (2003) as well as Maree and Pietersen (2007). These scholars assert that a pilot study must be closely linked by ensuring that all aspects of the pilot study (such as study site, participants, research instruments, procedure for data collection etc.) are similar to those for the main study in order to serve its purpose of informing the main study effectively. The only difference should be the smaller number of participants in the pilot study than would be used in the main study. The purpose of the pilot study was to assess the suitability of research instruments and procedures for collecting data (Borg & Gall, 1989; Gay, 1996; Oppenhein, 1992; Sproull, 1988; Wiersma & Jurs, 2005). The pilot study was also meant to assess the appropriateness of seating arrangement, as well as whether or not the researcher would manage to gain access to information from female pupils, in terms of their willingness to talk openly and freely, about the issues the researcher would raise, as well as recording procedure for data (Litosseliti, 2003).

3.8 Data Collection Procedures

Primary data to answer the research questions was collected in the last two weeks of July 2010. In a qualitative study, the researcher is expected to collect data over a long period of time. However in the current study, enough data was collected within two weeks. This is because group interviews were used instead of individual interviews, making it possible for the researcher to collect adequate data within a short period of time (Punch, 1998). In addition, the use of purposive sampling of participants also contributed to collection of adequate data within a short period of time because the participants had the data which was required to answer the research questions. Regarding the duration for collecting data, Krefting, (1991) insists that there are no rules stipulating the duration of time a researcher should be engaged in collecting. The same data collection depends on the design of the study, and the particular purpose of the study. Furthermore, during the last group interview during the collection of data, in the current study, some information was being repeated, meaning that more or less saturation of data was recorded (Frankel, 1999; Meadows & Morse, 2001). Another issue which was considered during data collection was that a lot of people seeking for information visit schools in Lusaka very frequently. As result of this, some members of the school community had developed research fatigue. In view of this, the researcher did not want to extend his visits to these schools any longer than necessary.

Although the collection of primary data is costly and time-consuming in comparison to use of secondary data, the researcher opted for primary data because there was no suitable secondary data available to address the research questions for the current study as pointed out in the previous chapter. This means that data was collected from primary sources, who in this study were female pupils. Furthermore, the intention of the researcher was that in the report, quotes of what participants said regarding the issues being investigated, would be included, a practice recommended in a qualitative report to illustrate; support findings or to provide evidence (Corden & Sainsbury, 2006; Burnard, 2004; Tong, Sainsburg & Craig, 2007). Data collection procedures involved the following stages: gaining access to schools and research sites; gaining access to participants; collection of background data of pupil participants; conducting interviews and recording of interview data. Each of these stages is described in sub-sections which follow.

3.8.1 Gaining Access into Schools

Qualitative research approach requires that the researcher collects data at the place where the researched participants are (Borg & Gall, 1989; Creswell, 2003; Merriam, 1998). It, therefore, meant that the researcher had to go to schools to collect data from the female pupils. Gaining entrance into schools and meeting female pupils in schools was therefore important in this study. Before seeking permission from both the Catholic Secretariat and the provincial education offices, the researcher first thought that it would be difficult to get permission to conduct research in schools because a lot of people, including University students visit schools in Lusaka very often to conduct research. Therefore, there was a likelihood that there was research fatigue in schools. However, it turned out that it was easy to get permission into the four schools because of earlier interactions with officers who were in charge of granting permission before the visit to their schools. For example at the Catholic Secretariat, the researcher had been in one committee together with the person who was in charge of granting permission. At the Provincial Education Office, permission was requested through a former student who was working at the same place. Access was gained into schools using the following procedure: first of all, permission was requested from relevant authorities to conduct research in the schools. This was ethically important to do so (Cohen, Manion & Morrison, 2011). In this case, permission was sought from the Catholic Secretariat to collect data at one of the schools under their control and from the Provincial Education Officer for Lusaka province, to undertake research in three government high schools. Physical visits were made to these offices by the researcher and face-to-face discussions with the officers concerned were held. When seeking permission, the relevant officers were informed on the title of the research, its purpose and its importance in the promotion of female pupils' participation in science education. In both cases, permission was given in written form to conduct research at these schools (see Appendix **D** and **E**).

After obtaining permission from the Catholic Secretariat and the Provincial Education Office, visits were made to each of the target schools before embarking on data collection.

During the period, visits were made to schools, most of them were conducting their end of term examinations. The researcher was worried that they would not welcome him in their schools to collect data during this period. However, it turned out much more positive than thought as permission was granted. At each school, the researcher first met the headteacher or the headmistress before embarking on the study. This made it easier to collect data at these sites. At each school, the researcher introduced himself to the school administrator and provided verbal and written information about the study, including the letter of permission from either the Catholic Secretariat or the Provincial Education Officer, depending on the type of school. The introductory letter for school administrators contained the following information: purpose of the study; relevance of the study; why their school was selected for study; activities the researcher intended to carry out at the school and when they were intended to carry out; the target pupils; how the findings of the study would be reported and what the school would benefit from the study (Bogdan & Biklen, 1992; Cohen, Manion & Morrison, 2011). This approach is also recommended by Bell (1999) who advises that school administrators and participants need to be informed about what they would be required to do, how much time they have to give and how the information collected would be used. Permission was also sought for some female pupils to participate in the study. At all the four schools, permission was granted to collect data and a request was made to either head teacher or deputy head in the absence of the headteacher, to sign a consent form (see Appendix **F**) for the school.

3.8.2 Gaining Access to Respondents

After being given permission by the school administrator at a particular school to conduct the study, the researcher met the school JETS patron and briefed him or her about the study. That is, its purpose, relevance and procedures involved so as to win his or her support. Thereafter, the researcher worked with him or her to identify 12 female pupils within the JETS Club who would participate in the study. The following criteria were used for selection of pupils who participated in the study: (a) the female pupil must have been in grade 10, 11 or 12; (b) pupils must have been willing to share information with the researcher and other participants (i.e. members of the group interview); (c) pupils must have been active participants in the JETS Club; and (d) willingness to spare some of their time to participate in the group interview session.

The use of the JETS Club patrons in the purposive selection of participants had both strength and weakness. There was strength in the sense that the patrons knew pupils who could provide the required information very well as opposed to the researcher doing the picking of participants on his own. The weakness was that some patrons could has been biased in their selection of participants using the purposive sampling method. Wallen & Fraekel, 2001) state that there is normally an element of bias in purposive sampling. However, it is a strategy which is recommended by other researchers (see e.g., Tongco, 2007).

3.8.3 Collection of Background Data from Respondents

After selecting the respondents, the researcher requested for a meeting with them in the company of another person familiar to the pupils. The purpose of requesting for another person to accompany the researcher as he met the female pupils was to ensure that these pupils did not feel threatened by the presence of a male researcher from the University who they had not seen before. Neuman (2003: 124) asserts that participation in a research should be voluntary. He goes on to say that "it is not enough to get permission from people, they need to know what they are being asked to participate in so that they can make an informed decision" to participate or not. Following the writing by Neuman (2003), during the meeting with girls, the researcher introduced himself, revealed his background and the purpose of his mission to the school. He then explained to them what the study was all about, its relevance to various stakeholders (Kumar, 1996) and why they were selected to take part in the study.

Ethically, a research participant is required to sign a consent form as an indication that she has agreed to participate in the study voluntarily (Borg & Gall, 1989; Creswell, 2007; Christians, 2011), that is giving informed permission (Neuman, 2003). According to Denscombe (2007), when there is a written and signed consent, it protects the researcher from any accusation which may arise in future. In view of this requirement, a consent form (see Appendix **G**) was given out to all pupils selected for the study. This form contained the following information regarding the study they were being requested to participate in; purpose, procedures, benefits, discomforts, confidentiality and right to refuse to participate or right to withdraw from the study if need be. After giving each female pupil a consent form, the researcher went through it with the pupils, explaining each point. Pupils were assured by the researcher that if they accepted to participate in the study, their identities would be protected through use of fictitious names in the report. The use of fictitious names is recommended when writing a research report (see e.g., Merriam, 1998; Kumar, 1996) in order to conceal the identity of informants..

The purpose of having introductory sessions with participants was to create a condition of trust, cooperation and mutual respect between the researcher and participants (Borg & Gall, 1989; Wallen & Fraenkel, 2001) as well as to motivate them to give more information (Kumar, 1996). After taking them through the consent form, they were given an opportunity to ask questions on any issues which were not clear to them regarding the consent form and the study. Thereafter, they were requested to sign the consent form if they were willing to participate in the study. They all agreed to participate in the study by signing the consent form. Initially, the researcher thought that some of them would not accept to participate in the study because of differences in age, sex and type of learning institution where the researcher was coming from. Contrary to this thinking, participants welcomed the researcher.

Once pupils accepted to take part in the study, they were requested to provide background information about themselves using a self-completion questionnaire. The questionnaire was used to collect background data because normally there is little elaboration required on background data. The purpose of requesting each of the participating female pupils to provide some background information was to enable the researcher to understand each one of them better. This practice is in line with the view of Becker *et al.,* (2005) who point out that a short history is done on the participant of study for purposes of getting a clear understanding of the participant. It was important to understand participants' backgrounds because in some cases decisions made by individuals could be associated with their background factors (Lyons, 2004). For example, a study conducted in Swaziland found that background characteristics of female pupils influenced their decision to pursue science and technology programmes (Dlamini *et al.,* 2004). Pupils were given two days to write their background information. The process outlined above was carried out at each participating school.

3.8.4 Conducting Group Interviews

The researcher used the group interview method to collect data from female pupils in order to answer the research questions. Group interview is a way of collecting data which involves one interviewer interviewing a number of informants at the same time and venue (French, Reynolds & Swain, 2001; Punch, 1998; Bryman, 2001). Data is solicited by the researcher from participants through asking them oral questions (Punch, 1998; Sidcup, 1984; Kombo & Tromp, 2006). In this case, the researcher posed questions to participants to solicit for information. The interview method was used to collect data from female pupils instead of other qualitative methods such as observation, because it was the most appropriate to access the perspectives of female pupils regarding influences on their decision to join JETS Club, and this entailed gaining access into pupils' minds. Interviewing is the most appropriate way of accessing participants' views, feelings and experiences (Denscombe, 2007; Patton, 1990; Wallen & Fraenkel, 2001). Furthermore, since female pupils made a decision to join JETS Club before the study, their decision was considered as a past event and therefore interviewing them was the most appropriate way of acquiring knowledge of who influenced their decision (Merriam, 1998). Furthermore, a decision is not a behaviour or action which can be physically observed.

When the researcher decided to use group interviews, instead of one-to-one interviews, he was aware that there were challenges associated with collecting data using this method. Some of these challenges were: difficulties of getting participants in one place and at the same time as pointed out by Nieuwenhuis (2007); the possibility that the interview could be dominated by one or a few female pupils in the group (Lankshear & Knobel, 2004; Litosseliti, 2003); some female pupils may not be comfortable to express their views in the presence of other female pupils (Sidhu, 1984; Welman, Krugar & Mitchell, 2005) and therefore useful data may not come through. Other weaknesses perceived were that in certain cases, some female pupils may be selective in contributions or take a group position (Litosseliti, 2003) and, therefore, it would be difficult to get to know their own views. Manual recording and analysis of the group interview may be difficult (Kombo & Tromp, 2006). Furthermore, the small number of respondents participating in a small group may not represent the entire population of female pupils in JETS Club (Nieuwenhuis, 2007) and therefore the findings may not be generalised to the whole population of female pupils who are members of JETS Club (Litosseliti, 2003). In addition, analysis of data gathered through groups would take a long time (Litosseliti, 2003).

However, although collecting data using group interview method has several demerits highlighted above, the researcher opted to use it because of the following reasons: the researcher was of the view that this was the most appropriate method for obtaining data from pupils, particularly female pupils unlike using the one-to-one interview which could be intimidating (Descombe, 2007) to them, especially that the interviewer was an unfamiliar man; it would enable collection of more detailed data to answer the research questions, compared to what would be collected from interviewing participants individually (Morgan, 1988; Glesne, 1999; Glesne & Peshkin, 1992). This is because through the use of group interview, views expressed by some members of the group would perhaps make others remember certain information relevant to the issue under investigation, which they may not have remembered in a one-to-one interview (Punch, 1998; Lankshear & Knobel, 2004). This would therefore improve the quality of data provided.

Other reasons which made the researcher opt to use group interviews were that this technique would be less time-consuming and less costly for getting data from 48 female pupils than individual interviews with every female pupil (Lankshear & Knobel, 2004; Welman, Kruger & Mitchell, 2005; Punch, 1998) since more female pupils would be interviewed in a single session. Group interview would also increase the sample size (Moragn, 1988; Marshall & Rossman, 1999). Another justification for using group interview was that it would enable the researcher to gather a large amount of detailed data related to the research problem in a short period of time from pupils, which would not be possible if individual interviews were used (Punch, 1998). This was the case in the current study; another reason was that it would give an opportunity to the researcher to interact with female pupils being studied, as well as probe them when there was need to seek clarification or make additions to incomplete responses (Borg and Gall, 1989), which would not be possible if for example, a questionnaire was used. Group interview was also more appropriate than individual interview in a situation like the current study, where a male researcher was soliciting for information from young female pupils.

Efforts were made by the researcher to minimise the weaknesses of group interview cited earlier on. For example, he ensured that during interviews, sessions were not dominated by a few female pupils, by giving chance to other participants to talk. The participants were also encouraged to freely give information without fear of other group interview participants since they were from different grade levels. Furthermore, since participants were pupils, the issue of getting them together at one place was not a problem in the current study because they were available within the school. However, before the researcher went to a school for interviews, a reminder was sent to the contact person at the school to ensure that he or she was aware of the researcher's coming to the school, and for him or her to organise the girls and other requirements (such as a suitable room) accordingly.

Group interview participants were uniform in terms of sex but heterogeneous with respect to educational levels and age as shown in Appendix A. From the experiences of the pilot study, a uniform group in terms of sex, education levels and age would have been ideal (Litosseliti, 2003) for the main study. However, this was not possible because of the small number of possible participants and the longer time it would have taken to collect data if participants were split into smaller groups to ensure that they were homogeneous. With respect to the number of participants per group, there seems to be no commonly-agreed minimum and maximum numbers in that different numbers of participants have been suggested by scholars. For example, Morgan (1988) recommends a minimum number of 6 and a maximum number of 10 participants. Kitzinger & Barbour (1999) are of the view that the ideal size is 8-12 participants; Brown (1999) suggests a range of 4-12 participants, while Green and Hart (1999) recommend a range of five-six participants per group. Denscombe

(2007) recommends a range of six-nine participants. In the current study, the researcher used a maximum number of 12 female pupils per group. The researcher chose this group size because in his view, it was not too small to prevent a good interaction and not too large to cause problems of control as well as prevent others from expressing their views.

Bell (2002) advises that people who accept to be interviewed need to be considered, meaning that their schedules or their other commitments should be taken in account. In view of this, interviews were held with female pupils in their respective schools, in the afternoon, when they were not attending lessons because the researcher did not want to disturb their learning. Furthermore, they were conducted on the days recommended by the school administrators as being the most appropriate ones for the school and the pupils to be interviewed. In addition, all schools made effort to provide a venue which was considered to be the most ideal for group interviews in terms of sitting arrangement and quietness. With respect to sitting arrangements, a semi-circle type was used in which all participants faced each other. Only members of the research team (i.e., one note-taker, one video camera operator and researcher) and the participating girls attended the interview sessions. Borg and Gall (1989) state that the presence of other individuals when interviewing could be a source of incorrect data. Thus, it could also be possible that the presence of three strange males would have discouraged some female pupils from freely expressing their views.

Group interviews proceeded as follows: to start with, the researcher welcomed participants and thanked them for finding time to participate in the group interviews (Litosseliti, 2003). Thereafter distributed name tags to members of the group and requested them to write their first names only. The use of name tags enabled the researcher to call participating girls by their names during the interview session, which was important for recording the proceedings of the session. Furthermore, calling participants by their names also helped to build a friendlier non-formal environment for sharing of views and experiences (Litosseliti, 2003). Pupils feel valued when they are called by their names and management of the group also becomes easier.

Interview sessions started with an introduction (Bryman, 2001; Wisker, 2001), during which the researcher again informed participants who he was, where he was coming from and what he was doing. Other people who were with the researcher were also introduced. The purpose of the study (Welman, Kruger & Mitchell, 2001) and session (Litosseliti, 2003) were explained and participants were reminded that participation in this study was voluntary. However, the researcher encouraged them to participate by explaining to them why it was important for them to participate in the study. One of the arguments used to encourage them to participate was to tell them that participation would give them an opportunity to share their opinions and experiences in JETS Club with other people. Through this sharing, people would get a better understanding of JETS and its importance to female pupils.

The researcher further informed participating female pupils that he came to learn from them (Morgan, 1988) on a number of issues related to their joining of JETS Club. He also mentioned to them that there were no 'wrong' or 'correct' responses and therefore they needed to express their opinions, views and experiences without fear of being told that the response was wrong (Litosseliti, 2003). They were also encouraged to air their views different from the rest of the other girls in the group if they had any, without fear. The researcher also told them that he wanted to know their experiences and views of the issues under consideration and that whatever they would say would be regarded as important. Additionally, the researcher informed participants that the information which would be shared during sessions was confidential and therefore should not be shared with people outside the group. The purpose of sharing all these things with female pupils was to create a relaxed atmosphere where the pupils would feel free to provide as much information as possible on the topic under investigation (Litosseliti, 2003; Denscombe, 2007).

Participants were also told about the expected duration of the interview session which was for two-and-half hours. Providing information on the duration of the interview is recommended in research (see e.g., Wisker, 2001; Bell, 2002). In order for the discussion to run smoothly, ground rules were required which would guard the participant (Wisker, 2001). Therefore, before the group interview started, the researcher and interviewees agreed on ground rules to protect the interaction during the session. With respect to ground rules for the focus group, Morgan (1998) suggests the following: only one person to talk at a given time; no mini-discussions amongst participants seated next to each other. For this study, the researcher applied these ground rules in the group interviews held with female pupils. After introducing himself and the study, interviewees were given time to ask questions (if any) and to say something briefly about themselves.

The researcher started the interview session with easy questions first as recommended by some scholars (e.g., Denscombe, 2007; Litosseliti, 2003; Koshy, 2005), in order to put participants at ease and to stimulate them to talk (Kumar, 1996). In this case, the first question was 'how they came to know about JETS Club and when they came to know about JETS Club.' See Appendix **C** for details of questions asked during group interviews. Furthermore, simple English was used to make sure that what the researcher said was easy for female pupils to understand (Merriam, 1998; Welman, Kruger & Mitchell, 2005). Where necessary, the local language was used to get them to understand. During the course of the discussion, probes were used to persuade participants to supply more data on an issue (Denscombe, 2007; Merriam, 1998) where it was necessary.

Just before the interview session, the researcher requested participants to raise any points related to the issue under consideration through the use of questions such as 'do you have anything more to add or have we left out anything in our discussion?' as recommended by Litosseliti (2003). At the end of each interview session, the researcher thanked the participants for the information provided and for having spared their time for the interview (Berg, 2007; Bryman, 2001; Estrada & Laurence, 2002; Wisker, 2001). Soft drinks and biscuits as well as pens were provided as a way of thanking the participants and maintaining good relationship with them. This act is in line with what some scholars who have advocated good relationship.. For example, Kumar (1996) contends that showing appreciation through giving a token, after having got the information is not an immoral act. Similarly, Litosseliti, (2003), Krueger (1994) and Barnett (2009) also recommend this practice. The interviews lasted for about two and half hours from about 14.00 to 16. 30 hours.

3.8.5 Recording of Interview Data

Three methods of recording data, namely, digital voice recorder, video recorder and taking down notes were used during the interview sessions. Recording of data during interview session is recommended by Best and Kahn (2006) as being an appropriate method of taking record of the interview session. However, before starting to record, the researcher asked for the participants' permission to record and explained to them why he needed to record the discussion as suggested by Borg and Gall (1989) in order to gain their confidence as participants and to reduce fears. The researcher was aware that recording of interviews has some disadvantages. For example, recorded information requires a lot of listening and when it comes to transcribing, it requires a lot of time and is costly (Koshy, 2005; Merriam, 1998; Sinnes, 2005; Descombe, 2007). Furthermore, it may make some participants uncomfortable. For example, Borg and Gall (1989) observe that in some cases, the presence of a tape-recorder alters the discussion environment and makes some participants feel uneasy to express themselves freely. This point is also supported by Koshy (2005) as well as Bell (2005) who point out that use of a tape-recorder may discourage some interviewees from telling the truth about an issue because of fear of the unknown. Denscombe (2007) also adds that during the process of transcription, some genuiness of data is lost. There are also problems associated with quality of recording, meaning that it is possible to have low quality recording and difficulties in identifying who is talking at a particular time (Litosseliti, 2003).

However, despite the weaknesses associated with recording cited above, in the current study, the researcher was convinced that it would be more appropriate to record the group interviews, in that this would reduce disruption of the flow of information during interviews which would occur if the researcher was moderating the interview and also taking notes during the interview session. Furthermore, recording would make it possible to play back the tape several times for transcription purposes and this would improve the quality of the study (Borg & Gall, 1989) by capturing exactly what female pupils said. Recording is also recommended by Litosseliti (2003) and Koshy (2005) as the best way of capturing what is said during interviews. In supporting audio recording, Denscombe (2007) argues that, with regard to verbal communication, it gives a complete record which cannot be easily changed and that, as a result of recording, data can be verified by another person. Its other strength is that transcription of tape recorded data enables the researcher to be familiar with the data (Denscombe, 2007), which was the researcher's experience in the current study.

Although a digital voice recorder and video-camera were used to record interview sessions, there was one assistant who was taking down notes. His presence may have made some female pupils uneasy, however this arrangement had an advantage in that, should any of the devices fail to record for one reason or another, a record of the proceedings of the interview sessions captured by the person who was taking down notes would still be available (Creswell, 2003). Furthermore, written notes also helped the researcher when he was transcribing recorded data to counter-check the accuracy of transcribing. The use of both audio recorder and a note-taker for recording the discussions is also supported by Litosseliti (2003).

The process of collecting data and recording described in the sections above were used at each participating school. The researcher conducted a group interview at each of the four schools because he did not want to base his findings on one group interview held at one particular school. Denscombe (2007) cautions against basing findings on one interview because it may not capture different perspectives.

3.9 Data analysis

Rabiee (2004) advises that data analysis procedure should be described in detail in such a way as to enable another researcher to corroborate the outcome of the research. Rabiee (2004) further states that a good account of the procedure used to analyse data increases the thoroughness of the research. Descombe (2007: 302) makes a similar point as follows "those who use qualitative data are now expected to include in their accounts of research a description of the processes they used to move from the raw data to their findings". In view of the advise given by Rabiee (2004), an account of how the researcher carried out analysis of data in the current study is given below. It should be mentioned that to give a very clear account of the data analysis process was not easy because the process was not straight-forward. It involved moving forward and backwards. As Marshall and Rossman (1999:

150) said “it is a messy, ambiguous, time-consuming … process. It does not proceed in a linear fashion.”

Data analysis took place concurrently with data collection, a practice recommended by other scholars (e.g., Creswell, 2003; Marshall & Rossman, 2006; Merriam, 1998; Rabiee, 2004). This means that as soon as data had been collected for one school, the researcher started data analysis (Sarantakos, 2005) and this continued as more data was collected from the other three schools until all data had been analysed (Gay, 1996). This is in line with the views held by Silverman (1993) who says that qualitative data analysis commences during data collection stage. Data analysis involved a number of steps. The first step was for the researcher to familiarise myself with the interview text. This was accomplished through listening to and watching the video tapes of the interviews held with the female pupils and transcribing them. Initially, the responses given by female pupils were written by hand on pieces of paper and then these manuscripts were typed using a word processing computer programme. The researcher then read the interview transcripts several times, a practice recommended by Descombe (2007); Wallen and Fraenkel (2001) and Nieuwenhuis (2007). This was done to further enhance the researcher’s understanding of what the respondents were saying.

After having familiarised with the various types of responses given by respondents by reading and re-reading, the researcher started putting away some data which he thought at this point in time was not very relevant to answering the research questions. Miles and Huberman (1994) refer to this process as ‘data reduction’. Thereafter, the researcher went through the data again, carefully and began coding the data by assigning codes or tags to parts of transcribed data (Miles & Huberman, 1994). Codes may take the form of names, numbers, initials (Descombe, 2007) or words while coding units could be paragraphs, sentences, words (Bradley, Curry & Devers, 2007) or lines in the text (Descombe, 2007). In the current study, words were used as codes, and paragraphs and sentences mainly as coding units. In the process of coding data, the researcher marked paragraphs and in some cases sentences of the transcripts on the side with descriptive words.

After coding the transcribed data, it was cut into pieces (data bits) using a pair of scissors, a strategy used by other researchers (see e.g. Dye, Schatz, Rosenberg & Coleman, 2000). Each of these data pieces consisted of a response from one female pupil. This process resulted in a big pile of pieces of paper consisting of responses from participants. The next thing that had to be done was to generate categories. Categories are broad groups under which several codes may be put (Denscombe, 2007). There are two positions regarding creation of categories. One position (inductive) is that categories should emerge from the data (Glaser & Strauss, 1967; Strauss & Corbin, 1998; Berg, 1995; Nieuwenhuis, 2007; Trace, 2001; Cohen, Manion & Morrison, 2007). Scholars who hold this view argue that letting categories emerge from data naturally instead of using predetermined categories allow unexpected categories to be given chance to emerge also (Trace, 2001). They also argue that use of predetermined categories does not promote a good way of breaking the data because an investigator may not see certain aspects of the data (Denscombe, 2007), thus limiting the findings (Eisenhardt, 1999). The other position (i.e. deductive) with regard to creation of categories is that codes and categories should be determined before analysing data from review of literature and theoretical framework. This means that data generated from interviews should be fitted into these predetermined analytical frameworks or start-lists (Miles & Huberman, 1994). They argue that pre-conceived frameworks permit new investigations to gain from existing knowledge in the field and build on them (Bradley, Curry & Devers, 2007).

For the first school, the researcher created categories from data inductively using the constant comparative technique (Glaser & Strauss, 1967; Cohen, Manion & Morrison, 2007). This technique involved sorting out the data segments into smaller piles that had something in common or were connected in some way, by comparing each of the data segment assigned to a category with each of those previously assigned to that category. Data segments were classified according to research questions. After generating piles of data segments, the researcher came up with initial category names for each pile of data segments. However, when analysing data for the last three schools, the researcher additionally used aspects of deductive approach of sorting out data because some of the categories were already established when data for the first school was analysed. Thus, some of the data segments had to be fitted into the categories created when dealing with data for the first school. Thus, in the current study, both inductive and deductive approaches of developing categories which Bradley, Curry and Devers (2007) refer to as the 'Integrated Approach' were used.

The researcher continued refining the codes and categories throughout the analysis of data from respondents at four schools by moving forward and backward. Through this process, category headings were generated from the data and these are used to report findings in the chapter which follows.

3.10 Collection of Data from Teachers and its Analysis

Eisenhardt (1999) advises that during the course of the study, changes can be made to include additional data sources. In line with Eisenhardt's (1999) view, interviews were held with eight teachers individually during the National JETS Fair held during the first week of August 2010 to get their perspectives on influences on female pupils' decisions to join JETS Club as well as benefits and challenges female pupils experienced in the club. This was done after analysing data from female pupils. Appendix **H** shows some of the questions asked to teachers. Teachers were selected for interview on the basis that they had been interacting with girls in JETS Club for a long time and that they were willing to be interviewed. This sample of teachers was adequate enough to provide multiple perspectives for the purpose of this research. Table 6 shows the sex and positions of teachers interviewed.

Table 6: Sex and Positions of Teachers Interviewed

Sex	**Position held**
Male	JETS Club Patron
Female	Standard Officer for Science
Female	Head of Science Department
Male	Head of Science Department
Male	Science Teacher
Female	Science lecturer
Male	Standard Officer for Science
Female	Regional JETS Organiser

Source: Field data

Denscombe (2007) asserts that getting information from different sources can enable the investigator to get better knowledge of the issue being studied. This point is also supported by Gilchrist (1999) who argues that the use of multiple sources of information and multiple methods improves validity of the study. Others in support of this approach are Borg and Gall (1989), Patton (1990) and Merriam (1998). For example, Borg and Gall (1989) point out that the use of different methods for data collection on an issue as well as collecting data from different sources at different periods, and in different areas contributes to confidence in the study. With respect to analysis of data collected from teachers, the researcher used the same approaches employed for analysing data generated by interviewing female pupils given in section 3.9.

3.11 Procedures used to Validate Findings

According to Merriam (1998), the methodology chapter should include a explanation of steps taken to enhance the validity of findings. Thus, In this section of the chapter, an account is given of steps taken to validity the findings. Patton (1990) as well as Strauss and Carbin (1998) point out that it is not possible to achieve complete objectivity in any research. Despite this view, in the current study, effort was made to improve the validity of findings as much as possible. Following the advice given by Merriam (1998), the researcher did the following to address threats to validity: collecting data in different schools to ensure that different contexts were captured as well as different perspectives from different teachers; Interviewed different female pupils in the four schools to capture different perspectives and checked one informant's reason for joining JETS Club against other respondents (Denscombe, 2007); recorded group interviews (using digital voice recorder and video-camera) to ensure that all sound communication during interviews was captured; listened to the recording several times during transcription to ensure that the transcribed data corresponded with spoken words as much as possible.

Detailed descriptions were used to report procedures for data collection and analysis used in the study so that other researchers who would like to replicate the study may do so without difficulties. Guidance was sought from the researcher's supervisors on the categorisation of data. Findings were reported in detail (through use of quotes) in order to provide as much information as possible to would be readers of the report (Creswell, 2003). Colleagues (i.e. fellow lecturers), and the researcher's supervisors were used (as critical readers) to examine and make comments on the report so as to improve the quality of the account. A pilot study was conducted to check on the appropriateness of the study design, research tools and procedures for data collection before embarking on the main study. The researcher established trust, cooperation and mutual respect between himself and female pupils who participated in the interviews so that they could share their views, experiences freely during the interview sessions.

Other measures taken to improve the validity of findings of this study included the following: holding interviews in places which were acceptable to participants, and which were conducive to discussions and creating conditions in which participants were able to speak as frankly as possible; reducing the duration of the interview sessions where possible so as to avoid participant fatigue which could affect the quality of responses from female pupils; holding interviews at times which were convenient to participants so that they were not inconvenienced; and asking questions during interview sessions which were relevant to the research question in order to generate relevant data.

Others included making effort to ensure that participants understood the meaning of the questions posed during interview sessions by using simple English and where necessary explained the question in a local language (Merriam, 1998). Using open-ended questions during interview sessions to give an opportunity to participants to express themselves without being restricted. During interviews, the researcher probed respondents, when necessary to get more data. When sampling the researcher purposively selected respondents who were thought to have information to answer the research questions in order to get as much information as possible. Finally, participants were given chance to bring out whatever they thought had not been raised during the interview, which they thought was relevant to the issue under investigation, to ensure that all possible perspectives and experiences are captured.

3.12 Ethical Considerations

Consideration of ethical issues at every stage of the research process is important (Creswell, 2003; Cohen, Manion & Morrison, 2008; Denscombe, 2007; Reynolds, 1979; Koshy, 2005). With respect to researching, ethical approaches may be interpreted as conducting research in morally correct or acceptable ways.

In the current study, the researcher took the following steps as recommended by Kumar (1996), Litosseliti (2003), Denscombe (2007) and Creswell (2003; 2009), to ensure compliance with ethical conduct at various stages of the study. During the identification of the research problem, consideration was given to the problem as whether it was important or not. The researcher was convinced that it was important and that the findings would be useful to female pupils and other stakeholders in enhancing their participation in science and technology based extra-curricular activities. Before going to school, the researcher sought permission from the Ministry of Education (specifically from the Provincial Education Office of Lusaka province) and proprietor of Catholic mission schools (Catholic Secretariat) to conduct research in their schools.

At each school, researcher revealed his identity and background to head teachers and participating female pupils so that they know who he was. Before embarking on collecting data, permission was got from head teachers (gate keepers) at each school to conduct research in their schools involving female pupils in JETS Club. The researcher explained the purpose of the study, type of data wanted, the procedures of the study and informed the participants what they were expected to do as well as how the study would impact on them i.e. informed consent was sought from female pupils) .

Other steps taken took to ensure ethical compliance included assuring participants that information they would provide would be used for research purposes only and that their actual names and that of the school would not be given in the report as recommended by Creswell, (2003) and Litosseliti, (2003). Instead fictitious names for participants and schools would be used.

Steps were taken to ensure that no harm (physical and psychological) was caused to those who participated in the study by measures such as conducting interviews in places which were transparent. Other measures were getting permission from school authorities as well as requesting the school authorities to indicate the most appropriate day, time and venue for interview session. The researcher also ensured that the activities of participants (e.g. attending lessons) and the school are not disturbed through measures such as conducting group interview when participants were free. Before starting to record group interview sessions, the researcher explained to participants why he needed to record the interview and requested for permission from them to do so. Furthermore, the researcher strongly requested participants to keep to themselves what they heard during the interview sessions and gave them opportunity to ask questions where they were not clear. The researcher also ensured that the words used in the report were fair. For example instead of using the term 'subject', the term 'participants or respondents' was used.

CHAPTER FOUR

PRESENTATION OF FINDINGS

4.1. Research question 1: What factors might have influenced female pupils' decision to join JETS, a club which is erroneously perceived to be a boys' club?

Regarding what might have influenced female pupils' decision to join JETS Club, six factors emerged from the data supplied by respondents. These are personal, family members, peers, club members, teachers and the media .

4.1.1 Personal Factor

One type of personal factor which emerged from responses provided by female pupils interviewed as having influenced their decision to join JETS relates to challenging existing gender norms. That is, there a belief by society generally that scientific, technological, engineering and mathematical related activities such as JETS Club, are meant for males and are stereo-typed as a male domain (Kahle & Meece, 1994; Erinosho, 2001a). Hence girls are socialised away from participating in such activities since society has adopted stereotypes in roles girls are expected to do in life (Grint & Grill, 1995). However, a number of female pupils believed that they were equal with male pupils in terms of mental ability and felt that they should also be in JETS Club as male pupils are, to counteract the perception that female pupils can not engage in STEM activities. Two of the female pupil participants put it as follows:

> There is this thinking that boys are always intelligent, boys are always the ones who perform extra-ordinary and stuff like that. So I myself, I said God created a man and woman, he said the man is in charge but he did not say the man is supposed to have more knowledge than the women. So I said to myself if a boy can do it, then I can do it too. So I chose to join JETS to challenge this thinking that JETS is for boys **(Idah, Duiker High School).**
>
> People were saying as a girl, I cannot do sciences. So I told myself that I have to show those people that even girls have the same brains as boys. That is why I joined JETS to show

> people that I [as girl] can also do better in JETS like boys **(Dorcus, Eland High School).**

The sentiments expressed above by some female pupils were also supported by some teachers interviewed, who said that some female pupils were influenced to join JETS Club because they wanted to break the gender stereotype which specifies different activities males and females are expected to engage in, through engaging in activities perceived to be for male pupils only. They said:

> Female pupils decide to join JETS Club so as to do things which are normally done by boys **(Male, JETS Club Patron).**

> They want to show that what the boys can do, they can also do **(Female, Standard Officer).**

The desire to participate in JETS Club competitions and also to compete with male pupils in JETS Club activities were also cited by participants as the reasons for deciding to join JETS Club. Boys are generally considered to be intellectually better in STEM-related activities (Mwase *et al.,* 1999). Thus, by participating in competitions with them, they wanted to demonstrate their sameness intellectually. Some of the participants put it this way:

> One of my most important motivations is to show boys that it is not only them [boys] that can participate in such competitions. Even us girls, can do it and can actually be better than they are. So I wanted to show them that they are not the best **(Elinah, Buffalo Secondary School).**

> I have a brother who was at Calistus [Secondary School]. So everything he did was compared to my performance. His performance was better than mine and the reason was that he was in JETS Club. From Grade 8, he had been doing projects each year. Each year, They [family members] would say 'your brother is more intelligent than you'. I would say 'no, I am sure I can do much better than him'. So in a way, competition with my brother also made me decide to join JETS. I have always wanted to be better than my brother (**Agnes, Buffalo Secondary School).**

The sentiments expressed above by female pupils are in line with prior studies (see e.g. Baker & Leary, 1995; Wan, 2006), which found that desire by female pupils to show that they were intellectually as good as male pupils, influenced their decision to enrol in a science subject.

Some of the teachers interviewed confirmed the motives given above by participants for deciding to join JETS Club. That is, they were of the view that some of the female pupils were influenced to join JETS Club because of their desire to compete with male pupils in JETS Club. Two of them said:

> They [female pupils] want to compete with boys and prove themselves that they can possibly do better than boys (**Male, JETS Club Patron).**
>
> Some female pupils decide to join JETS Club because they want to compete with boys in JETS Club **(Female, Head of Science Department).**

The competitive spirit possessed by these female pupils contradicts the belief that female pupils do not like a competitive environment (Rosser, 1990; Gatta & Trigg, 2001; Ekine & Abay, n.d.). However, the desire to demonstrate that they were equal intellectually, with male pupils, correlates with the perspective held by the liberal feminists with regard to intellectual ability between females and males in relation to science (Sinnes, 2005). They argue that the two are equal.

Some participants disclosed that they decided to join JETS Club because they considered themselves as having the mental ability required to undertake the Club activities, against the perception by society at large, that they would not manage to undertake such activities because their mental ability was perceived to be lower than that of male pupils (Adamuti-trache, 2006; Mulemwa, 1999a; 2002). They said:

> I wanted to prove to people that I can do it because I have the intelligence. If others have done it, I can definitely do it **(Grenda, Eland High School).**
>
> My mother did not just believe in me that I could join JETS because she said " you cannot even fry an egg". But I told her that " I was capable of doing other things" **(Albertina, Eland High School).**

Some of the teachers who participated in the study were also in support of the sentiments expressed by some female pupils, who stated that they decided to join JETS Club, because they held the belief that they possessed the required intellectual muscle to undertake JETS Club tasks successfully. Two of them said:

> Some [female pupils] think that they have the ability to do what is expected of them as club members **(Male, JETS Club Patron)**.
>
> Some female pupils think they have the ability to do what they are expected to do in JETS Club (**Female, Head of Science Department).**

The belief possessed by these female pupils contradicts some of the previous studies (e.g., Clewell, Anderson & Thorpe, 1992; Mwase *et al.,* 1999; Barba & Reynolds, 1998) which found that female pupils had a belief that they did not have the intellectual ability to engage successfully in science-related activities. However, this finding is in agreement with the Self-efficacy Theory which posits that people decide to engage in an activity based on their self-judgement of their ability to accomplish the task (Bandura, 1986) and the Expectancy – Value Theory which states that the decision to engage in an activity depends among others, on beliefs about one's ability (Eccles *et al.,* 1983). It also agrees with previous studies which found that high self-efficacy influences positively, enrolment decisions into a club, subject or career (Olszewski-Kubilius & Yasumoto, 1994; Lyons, 1998; Cleaves, 2005).

The desire to challenge the stereo-typical selection of after-school interests of female pupils from arts to sciences was another factor which influenced some of the female pupils decide to join JETS Club. In schools, in Zambia, it is unusual for a female pupil to have interest in engaging in both science and non-science extra-curricular activities. However, in this case, some female pupils belonging to an arts club also decided to join JETS. In this regard, participants claimed that by belonging to the Drama Club as well as joining JETS Club, they would act as role models to other female pupils. They would prove that it was possible to belong to both, an arts based extra-curricular club as well as a science-based one. One participant put it this way:

> I decided to join [JETS] because I wanted to be an inspiration to pupils so that more girls can be inspired to join JETS. This is because most of the girls at this school just like going for drama and things like that. Even if I am also in Drama Club, I am a JETS club member. So I also want to encourage them that even if you are a dramatist you can also join JETS **(Dorothy, Antelope High School).**

This reason advanced by these girls is new in that it has not been advanced by any one from the literature reviewed. Teachers interviewed also did not advance anything close to this.

The human rights issue emerged as a factor which influenced some female pupils to join JETS Club. One participant observed that it was a fundamental human right for girls to have access to education and take all subjects including science, a subject considered to be a pillar for social transformation and progress in daily life. In some schools, female pupils are discouraged by teachers and some family members not to join JETS Club because it is associated with activities which are said to be mentally demanding. However, one participant felt that she had every right to belonging to JETS Club. She put it this way:

> What made me to join JETS was my choice because I have got the right to do whatever I want to do **(Dorcus, Eland High School).**

Again the fact that some female pupils decided to join JETS Club because it was their right to do so is a new finding which had not been reported in any of the previous studies reviewed.

The desire to secure financial assistance to pursue further studies in their areas of interest not offered within Zambia, but outside the country was another factor which emerged as having influenced some female pupils decide to join JETS. Many families in Zambia struggle to secure funds to sponsor their children in particular, to colleges and universities, even within the country in light of limited funds, and whenever government sponsor-ship is not available. Some people discontinue schooling even when they are offered places in higher institutions of learning due to non-availability of financial support. In most cases, girls are affected by this, because in a situation where a family has to choose who to support, they normally go for a boy (Davison, 1993; Kelly, Msango & Subulwa, 1999). Therefore, to avoid stopping school, some female pupils have to think of how they would secure financial support especially in cases where they intend to study science based-programmes outside Zambia. Thus, these girls were of the view that through participation in JETS competitions, they would win a scholarship like what others had done in the past. Some said:

> According to what I know, the branch of science I want to study is not available at University of Zambia [UNZA] or at Copperbelt University [CBU]. The only places I can find this programme is may be in Pretoria or Kenyatta [University in Nairobi]. So I was thinking that joining JETS would help me to get a scholarship in Grade 12 so that my parents would not waste money on me to go to an expensive university **(Agnes, Buffalo Secondary School).**
>
> I also thought that by being in JETS, there may be scholarships to go and study abroad for those who had done well since I am pretty sure there is no university or college in Zambia that offers a course for neurosurgeons **(Lucia, Antelope High School).**

The desire to secure financial support by female pupils in order to pursue further studies was also alluded to by some teachers interviewed, as a motive for deciding to join JETS Club by some female pupils. They were of the view that this was so because in the past, pupils who performed well in JETS competitions were rewarded with sponsorship to pursue further studies outside Zambia. They put it as follows:

> They [female pupils] have seen pupils who got scholarships to study outside the country through JETS Club. So girls get motivated to join JETS Club **(Female, Head of Science Department).**
>
> [Female pupils decide to join JETS because] they have heard of opportunities to get a scholarship to study overseas through JETS Club (**Male, JETS Patron**).

Participation in JETS activities was therefore considered as useful in terms of securing a scholarship. This finding is in line with previous studies (see e.g., Lyons, 2004; Wan, 2006) where usefulness of something was found to be an important influence on decision. Eccles *et al.,* (2002) considers usefulness as important factor, in their Expectancy–value Theory.

A number of participants said that the ambition to pursue science and a technology-based career or programme of study, such as engineering and medicine after completing high school education influenced them to decide to become members of JETS Club. They considered JETS as a window to getting them to study what they wanted in the higher institutions of learning. For example, some said:

> I have had this ambition ever since I was young to become a doctor. People around me have been telling me that to become a doctor, I am supposed to be good in mathematics and science. So to ensure that I even become better in these subjects in order to become a doctor, I joined JETS since it involves mathematics, science and technology **(Beatrice, Buffalo Secondary School).**
>
> I have always wanted to join JETS Club, because from Grade 5, I have always wanted to become an engineer. So I thought if I joined JETS it could help me. This year, I joined JETS Club. For me, my goal is to study mechanical engineering and I think JETS can take me to this career one day **(Olipah, Eland High School).**

Some teachers interviewed were also of the view that some female pupils were attracted into joining JETS Club because they believed that participation in JETS activities would help them to pursue science and technology-based careers of their desire in future.

> Some [female pupils] aspire for careers in science, mathematics and technology. They feel that by joining JETS, it would expose them to SMT related careers or prepare them for SMT careers **(Female, Standards Officer for Science).**
>
> They have desire to pursue science related courses after [High] school. They think that what they would do in JETS would prepare them to study SMT related courses such as engineering **(Male, Head of Science).**

This finding is consistent to some extent, with prior research done (McInerney & Marsh, 2005; Chimwayange & Davies, 2004), which established that perceived usefulness of an activity for entry in a future career influenced pupils' decision to enrol or engage in that particular activity.

Some participants reported that they decided to join JETS Club because they were of the view that being a member of the Club, and participating in its activities would enable them to acquire a better understanding of science and mathematics, which were generally perceived to be difficult learning areas, particularly for female pupils by society and female pupils themselves (Rosser, 1990; Davison, 1993). Since most JETS activities are science and mathematics-based, they felt that, participation in these activities would facilitate their learning of these subjects. Two participants expressed the reasons behind their decision as follows:

> From the school where I came from, I knew that JETS is based on mathematics and sciences. So what I wanted was to know more in mathematics and sciences. So I decided to join JETS **(Cynthia, Eland High School).**

> I decided to join JETS because I was also of the view that JETS would help me know more about science and it would help me get exposed to things that sciences involve **(Dorothy, Antelope High School).**

The motive given above by female pupils as having influenced their decision to join JETS was also supported by one of the female teachers interviewed. She explained that:

> They [female pupils] want to broaden their knowledge in science, technology and mathematics through participation in JETS activities **(Female, Standards Officer).**

From the literature reviewed, no previous studies have found out that female pupils join science-based extra-curricular clubs because they wanted to enhance their understanding of science and mathematics. Therefore, this is a new finding emerging from this study. However, some studies and scholars (Rennie, 2002; Awortwi, 2007; Mannion & Coldwell, 2008; Misra *et al.,* 2013) found that participation in science, mathematics and technology-based extra-curricular clubs enhances pupils' understanding of science and mathematics.

Interaction with other people was cited as one of the ways female pupils would enhance their understanding of science and mathematics. This is because JETS Club involves a lot of learning activities both within the school and outside the school. For example, during JETS fairs, there is a lot of interaction between teachers and pupils; people from society as well as among students themselves. One female participant expressed herself as follows:

> I joined [JETS] because I wanted to know more through people as we interact. I thought that in JETS, I could meet people who I could interact with, people who I could share my knowledge and views with and they can also teach me what they know **(Doreen, Duiker High School).**

Some teachers agreed with these views, as the following statements indicate:

> Some female pupils decide to join JETS Club because they think that JETS can improve their knowledge in science-based subjects through interaction with the highly talented friends both at school, district and national levels **(Male, Science Teacher).**

Other participants disclosed that they were influenced to join JETS Club by the desire to enhance their performance in assessment tasks in school. They cited sciences and mathematics as the subject areas in which they were particularly determined to achieve good results in the final examinations. In Zambia, good performance in the examination is important because it is the results of these examinations that are used for admission into higher institutions of learning. According to the Zambian education selection system, science and mathematics are important admission requirements. From their responses, pupils were not satisfied with the way they were being taught during time-tabled lessons. Two of them put it this way:

> Why I decided to join JETS Club, is the determination which I have to improve my grades in science and mathematics. I thought that may be JETS Club can help me to have good grades in biology, chemistry, physics and mathematics in my final examination (**Hellen, Duiker High School).**

> The main reason why I joined JETS was because I was looking for a club that would help me get the distinction that I need in science and mathematics examination **(Lillian, Eland High School).**

Some teachers interviewed also cited desire to obtain good results in the school certificate examinations which take place at the end of grade 12 as one of the motives which made some of the female pupils decide to join JETS Club. They claimed that past records had shown that some female pupils who were in this club obtained good results in their final examinations. Hence the desire by other female pupils to join JETS Club. They stated that:

> They have seen other girls perform well in science. One example is Pamani who was active in JETS. She is now pursuing medicine. Initially she was not good academically but through participation in JETS, she became good and got 8 points (i.e. very good results) in the grade 12 examination **(Male, JETS Club Patron).**
>
> Some female pupils who decide to join JETS Club have a desire to get good examination results because girls who participate in JETS normally get good results in examinations **(Female, Standard Officer for Science).**

Although there are no studies that have found that female pupils join extra-curricular clubs because they would like to score high marks, there are, however, some studies that have found that pupils who participate in extra-curricular activities, related to science have obtained good results in the examinations (e.g., Nchesi, 2001; Agholor, 1994; Chambers & Schreiber, 2004; Reeves, 2008).

Ambitions to come up with something new in science, associated with a female was also given by some participants as one reason why they decided to join JETS Club. They observed that most of the discoveries in science were done by men not women. As a result, women were not very much associated with scientific discoveries. Thus, some of the female pupils wanted to change this pattern and considered JETS as the most appropriate club to join in order to come up with a new invention which would be associated with a female. This aspiration, propelled them into JETS Club. This belief is consistent with the perspective of the radical feminist (Wajcman, 2007) who argues that most activities in STEM such as research and production of various scientific and technological materials are, mainly done by men making science and technology masculine. They posit that females must enter this domain and participate in scientific research, and production of material so that they can come up with knowledge and inventions which may be more useful to society (Shiva, 2001; Sinnes, 2005). Some participants put it this way:

> I decided to join JETS Club because I want to discover something. As we look at our science right now, you find most of the laws are named after scientists who are mostly male. So I would like to make a name. I am looking forward to that era where you find Francisca's law of what or Doreen's law of what. At least it should be named after a woman **(Idah, Duiker High School).**

> What inspired me to join JETS Club is the desire to discover something. When I attended JETS Club, I discovered that they do a lot or research. So I thought that by joining JETS, I would also discover something like the way Madam Marie-Curie did **(Ireen, Antelope High School).**

A similar motive given by participants for deciding to join JETS Club was also alluded to by a teacher. These teachers were also of the opinion that one reason female pupils decided to join JETS was to come up with something which had not been heard of before so that they could be recognised by society as having developed something new. One teacher put it this way:

> Some female pupils decide to join JETS Club because they want to discover something of their own so that they can make an impact in society or be remembered as having done something **(Male, JETS Club Patron).**

This finding is new in the sense that no previous studies have reported that female pupils decided to join an extracurricular club because they wanted to create something new. It is good that there are some female pupils who think that they can create something new, a thinking which is not common in Zambia, and yet it is important if the country has to advance and individuals.

Interest in scientific and technology-based activities also emerged as a personal driving force behind some, female pupils' decision to join JETS Club. This claim is in line with the Expectancy-value Theory. In as far as this theory is concerned, interest is an important factor in decision-making. This finding also agrees with a study by OLszewski-Kubilius and Yasumoto (1994), which found that pupils joined an extra-curricular club because of the interest they had in the club. Influence of interst on decisions taken by pupils has also been reported by Barnes, McInerney and Marsh (2005) as well as Boe and Henriksen (2011). In the current case, participants submitted that they decided to become JETS Club members because this Club's activities involved aspects of studying scientific processes, such as those taking place in plants, and mathematics which they found interesting. Two participants said:

> My passion for science was one other thing which influenced me to join JETS Club. I am one person who likes things related to science. For example, I like plants. They amaze [me] because I wonder what makes them respire. And for me, I want to prove why things happen the way they happen. So it is something that I have attached myself to **(Doreen, Duiker High School).**
>
> I knew that JETS Club is based on mathematics and sciences. I liked mathematics and sciences. So I decided to join JETS **(Cynthia, Eland High School).**

Some female participants disclosed that they decided to join JETS Club because they wanted to engage in a variety of investigations such as experimenting and research, which club members undertook during JETS Club sessions. Practical work is important in the teaching and learning of science. It is claimed, practical work makes it easier to understand theory and also cultivates interest in a learner. However, it has been observed that not much practical work is done during time–tabled science lessons (Haambokoma *et al.,* 2002) making learners passive most of the time. Furthermore, when opportunities are available for practical work, teachers encourage male pupils to experiment and be creative while female pupils are ignored (Nassor, 2001a). Female pupils enjoy hands-on learning or activities (Frost *et al.,* 2005) and research findings indicate that it enhances achievement (Houtz, 1995; Freeman, 1997, 2002). One aspect which extra-curricular activities focus on is to provide opportunities to pupils, to engage on their own and at their own time in practical work (Agholor & Okebukola, 1998). The desire by female pupils to join JETS Club because of opportunities for hands–on activities is in line with the findings of a study by Agholor and Okebukola (1998), which found that female pupils decided to join JETS Club because of opportunities available in the club to engage in investigations. Some of the participants expressed their reason for deciding to JETS as follows:

> Basically what made me join JETS was the experiments. I love to experiment and find new things **(Rachel, Buffalo Secondary School).**

> What motivated me to join JETS Club is that I like the research part where you are asked to research on a certain issue. While you are researching, you get to learn more **(Bernadette, Duiker High School).**

One teacher interviewed concurred with the assertion by some female pupils that desire to engage in extended investigations influenced their decision to join JETS Club because the Club provided openings for such activities. He said:

> Some female pupils join JETS Club because of the interest they have in JETS activities such as projects which gives them opportunity to find out things **(Male, Science Teacher).**

Other participants said that they joined JETS Club because they simply wanted to be in the company of Club members who were regarded by other members of the school community as being brainy. This echoes the finding of Mahoney, Harris & Eccles (2006) who found that pupils joined a club because they wanted to be with friends. In the current case, two participants put it this way:

> Before I joined JETS Club, I also heard that people who are found in JETS Club are mostly intelligent or brilliant people. So I was saying that if brilliant people are found in JETS, I must also be found there. So I wanted to associate with brilliant people so that I get to learn more from them and share ideas. This made me join JETS Club **(Loveness, Duiker High School).**

> JETS Club was considered to be a club for genius or intelligent people. So I wanted to be part of them. I wanted to feel like a genius (**Grace, Buffalo Secondary School).**

Being classified as intelligent is an attribute which is highly regarded by pupils and teachers. This is because every person wants to be regarded as someone who is intelligent and generally does things correctly. Therefore pupils would like to be associated with intelligence.

4.1.2 Family factor

The family also emerged as a factor which influenced some female pupils' decision to join JETS Club. Participant revealed that they were influenced to join JETS by family members (father, mother, brothers, sisters etc.) in different ways.

Some participants said that some family members who were working in science-related fields influenced them to join JETS Club through expressing statements which encouraged female pupils to challenge gender norms. For example one participant cited her mother who was in the science field as being the role model in her decision to go for science subjects. During the professional development activities she participated in, with other male colleagues, she (mother) performed very well among male course-mates. When she came back home, she shared her successes with some of her family members. The sharing of these successes , encouraged her to challenge existing gender norms. It also motivated her to take up something at school which would prove that she was as capable, mentally, as male pupils in science-related activities. This behaviour could be said to reflect a liberal feminist perspective. She described how she was motivated as follows:

> I got the inspiration to join JETS Club from my mum. She deals with sciences, and she is a meteorologist. Sometimes she goes for studies and when she comes back she tells me how good she is academically and that the males even fear her. So I thought that by joining JETS Club, I would also take part in scientific activities and be feared by some boys **(Lucia, Antelope High School).**

Another participant stated that her brother who did not consider her capable of doing anything, influenced her to join JETS. She went on further to say that she joined JETS Club so as to demonstrate to her brother that she was capable of doing certain things which were considered to be impossible for girls. This finding is new in the sense that it has not been reported in any literature reviewed. She asserted:

> I decided to join JETS Club because, I wanted to prove something to my brother that I can do something because every time I want to do something at home, he would say "no you cannot do this because you are a girl. So I wanted to prove him wrong **(Albertina, Eland High School).**

Thus, she had a high self-efficacy (Bandura, 1986, 1997). The attitude displayed by this female pupil is contrary to the perception held by some scholars and society at large, that female pupils have a low self-esteem with regard to their capabilities in science compared to male pupils (Mbano, 2001).

One participant said that she was inspired to join JETS Club by the sponsorship a family member who was in JETS Club was given to pursue further studies outside Zambia. She was of the view that through joining JETS and participating in its activities, she could also secure financial support to study outside the country, just like one of her relations did. She considered her cousin as a role model worth emulating (Bandura, 1986). She said:

> My cousin who was a member of JETS [Club] got a scholarship to study abroad. I joined JETS club because I also want to get a scholarship so that I can go out and study. By Joining JETS, I thought I would also get it **(Cynthia, Eland High School).**

Several participants indicated that they were persuaded to join the club by some family members. These family members were of the view that participation in JETS Club activities would assist female pupils to realise their desired future careers. Two participants explained how some family members influenced them as follows:

> The person who influenced me to join JETS Club was my grandmother. She was a nurse but now she is retired. I told her that at school there was this club JETS and what they do mostly is about science. Then, she told me "okay since you want to be a medical doctor and they talk about science, it would be better for you to join". **(Loveness, Duiker High School).**

> My father influenced me to join JETS Club. He is an engineer. He said that JETS would help me to achieve my desired career. I want to be an engineer like him. He told me that in his days, there was no JETS Club but if he would live again and JETS was there, he would join the club (**Elinah, Buffalo Secondary School).**

This finding is closely related to the finding by Blattel-Mink (2002), who found that females who were in the engineering career came from a families that provided an atmosphere which supports the decision to pursue studies in engineering. Furthermore, in most cases, some of their fathers were already in engineering.

Some participants reported that they decided to join JETS Club because of some family members, who told them that participation in JETS Club activities would be beneficial to them in terms of what was taught during formal lessons and subsequently enable them score good marks in the examination. Since participants had a desire to improve their understanding in class or perform very well in the examination, they felt that the advice given to them by some of their family members was to their advantage and therefore decided to join the club. Some participants related the influential statements of some of the relatives as follows:

> My sister told me that JETS Club is a club that is interesting and it can help me learn a lot. Like there are some subjects which I might not understand in class, I may be able to understand them in JETS **(Albertina, Eland High School).**

> I was a member of drama club at this school and then my father did not like it. He said that I should involve myself in other school activities that involve school work such as JETS, but I refused. My father said "JETS can actually teach you what you have not learnt in class and then learn them in class again". That would be on my advantage. I found what he told me to be useful and I decided to join **(Mary, Buffalo Secondary School).**

> JETS Club was mentioned as one of the extra-curricular clubs in the school. So my father asked what [the] JETS [Club] in our school was really about. I told him that it is just a club. They learn stuff like mathematics and science. Then my father said, "Don't you think it would be the club for you?" I said not really. Then he said, "Which club do you want to join?" I said something like choir, and he said "You can't sing". Then I was like "I will learn that is why it is called choir". Then he said, "I would prefer if you joined JETS because it would help you with your studies in mathematics and science. You would be ahead of the class and you would find really easy most science and score well in the examination". So, I joined **(Agnes, Buffalo High School).**

> My daddy told me to join JETS Club because it was going to improve me in subjects like physics and chemistry. I am not good in physics. So I joined JETS Club so that I could improve my grades (**Albertina, Eland High School**).

Some of the participants disclosed that they were motivated to join JETS by the good performance of some of their relatives in the final examinations, while some it was family members' outstanding performance in class through their participation in JETS Club activities. This influence is new in the sense that it has not been reported in any of the prior studies done. One participant described her brother's influence this way:

> My brother also did influence me to join JETS Club. He was at Kanga Boys [School] and he was also in JETS Club. His performance in the final examination was very good. He is the one who encouraged me to join JETS saying " this thing (JETS) is just okay and it will really help you in your science". Because of his good performance in the examination, I decided to join JETS too because I wanted to do well too **(Doreen, Duiker High School).**

Another participant described the influence of the sister as follows:

> My sister influenced me to choose JETS Club. She used to do better in class because of her being in JETS Club. My parents used to praise her very much each time she performed well. I also wanted some praises from my parents. So I joined the club **(Grace, Buffalo Secondary School).**

These female pupils considered family members as role models worth emulating. This finding is in line with those of Chimwayange & Davies (2004) and Wan (2006), who found that role models influenced pupils' decisions. It could also be said to reflect the vicarious learning aspect of the Self-efficacy Theory (Bandura, 1994), which posits that the success of others makes one think that she or he can do it also. However, no previous studies have reported influence on a decision to join a science club arising from a family member achieving high performance in class.

Teachers interviewed also gave family influence as a possible reason for joining JETS Club by some female pupils. The teachers were of the view that persuasion to join JETS Club could have been common from households, who knew about the benefits of being in JETS Club. One teacher put it as follows

> Some female pupils are encouraged at home to join JETS Club. Especially those from families aware of JETS Club **(Female Lecturer, Science).**

Other female pupils disclosed that they were influenced to join JETS Club by some members of their families who were in science-based careers and demonstrated interest in science-related issues. They encouraged them to participate in science-based activities. One participant described how her sister encouraged her as follows**:**

> One of my sisters is a pharmacist. She has also been loving sciences since school. So she encouraged me as well to study or work hard in the sciences. That is how she also introduced me to the JETS Club. She also encouraged me to join and that is how I came to join JETS. Basically, my sister just kept on talking about sciences. She sees the need to love sciences because for her it has helped her a lot and right now she is able to know about medicines and things like that. So she had also been encouraging me to work hard in sciences through joining JETS **(Juliet, Duiker High School).**

Other participants said that they decided to become members of the JETS Club because of the impressive scientific projects some of the family members of the participants came up with, while they were in JETS, and also because they admired the support some of the family members got while working on their JETS projects from some of their parents. They felt that they should join JETS so that they could come up with good projects which some members of their families did while in JETS Club, which won them awards. They also wanted to get assistance too, from some members of their family, in the process of working on their projects as others in the family did. Some said:

> I also have an uncle who was at St. Peters in Chamu [district] and was a member of JETS Club. He made a project which really inspired me to join the Club **(Sangster, Duiker High School).**

> The reason why I decided to join JETS Club was because of my elder sister. I could really admire my sister when she was talking about JETS Club and when she was making her

> project. When she was making her projects, dad would help her. So when she went to present it at the National Science and Technology week, she got the second prize and I was really inspired. I said to myself "if she can do it then I can also do it" **(Albertina, Eland High School).**

One participant disclosed that she decided to join JETS Club because of the influence of her cousin who she regarded to be brilliant. She further said that the relative encouraged her to join JETS Club because he (i.e., cousin) was of the belief that she had the intellectual ability to successfully engage in JETS Club activities, expected of her on the basis of her performance in the examinations. Being told that she was intelligent improved her self-esteem, which is important in relation to making a decision to engage or not to in an activity (Bandura, 1986).

> The inspiration to join JETS Club was from my cousin who happened to get the first position in chemistry Olympiads this year. He is very bright and he encouraged me a lot to join sciences and he says if a lot of people can do it out there, then I can also do it because I had that ability. Last year when the results came out he looked at my results and he was like these are the type of intelligent people that we want in JETS. Since he is in grade 12 he was like "these are the people we want to take over when we leave" **(Idah, Duiker High School).**

This finding above (i.e., assessment of a girl to be intelligent by a boy), is a departure from the expected, in that it is contrary to previous reports that some teachers, parents and some family members perceive female pupils, as not being intelligent enough to pursue STEM based activities (Mulemwa, 2002; Mbano, 2001; Ndunda, 1999 and Davision, 1993).

Some participants also narrated how some of their parents supported their decision to join JETS Club. they claimed that their parents were of the view that being in JETS would be useful to them, in terms of preparing them to get into the science and technology-based careers of their desire as well as being role models for other members of their families particularly male ones who they expected to have interest in science-related career. Some female pupils expressed their parents' support as follows:

> My parents were happy, since they know that I want to be a civil engineer. They thought that JETS would help me achieve my goal. When I told my mother that I want to be a civil engineer, she told me being a civil engineer is difficult and she told me to get involved with things that deal with sciences. So when I told her that I joined JETS, she encouraged me and said it would help me **(Cecilia, Antelope High School).**

> Being the first born, my parents were very proud. They were praising me, saying "I was a good girl and that I was setting an example for my brothers". **(Lucia, Antelope High School).**

A number of participants said that in particular, their mothers supported their decision to join JETS Club. They claimed that their mothers were of the view that it would enhance their performance in class, and that it would assist them get into science-based careers which they wished to pursue. This finding contradicts that of Blattel-Mink (2002), who reports that fathers more often advise their daughters to engage in STEM activities than mothers. Two participants described their mothers' positive response as follows:

> My mother said "I made the right decision that I should join JETS Club in that it is a good club". She said "JETS helps you with the way you perform in class. It helps you improve since sometimes they give you tests in JETS and some things that come in those tests, we learn them in class. Some of them you have never learnt them but they become part of the examination. So it helps you learn more things'. That is what she told me **(Getrude, Duiker High School).**

> When I informed my mum she was happy. She told me that I should continue participating in things that would help me achieve my dream of being a doctor and JETS was one of them **(Eunice, Antelope High School).**

This finding is in line with that of Olszewski-Kubilius and Yasumoto (1994), who found that some pupils decided to participate in an extra-curricular club because of the usefulness parents attached to science.

Some participants disclosed that some of their brothers also supported their decision to join JETS Club. For example, one of them said:

> The reaction from my elder brother was so good. He was happy to hear that I had joined JETS. This is because during his school days at Lila High School he used to be in JETS Club also and his performance was good. He was of the view that I could also obtain the same results as he used to do during his school days **(Hellen, Duiker High School).**

The finding that family members influenced some of the female pupils' decision to join JETS Club are consistent with those of Olszewski-Kubilius and Yasumto (1994), Listen, Peterson and Ragan (2009), Wan (2006), Kambikambi *et al.,* (1998) as well as Ferrari and Turner (2006), who found that support and encouragement from family members influenced some pupils to participate in extra-curricular activities. The finding that some female pupils joined JETS Club because some members of their families were in science-based field also confirm the findings of some researchers (Breakwell, 1992; Dalgety & Coll, 1992; Gogolina & Swartz, 1992) who found that having a family member who was in favour of science was a predictor for participation in science-based activities. The support and encouragement family members gave to female pupils in as far as the decision to join JETS is concerned could be said to reflect the verbal persuasion component of the Self-efficacy Theory (Bandura, 1986).

4.1.3 Peer factor

Inspiration and encouragement from friends, in particularly those who were members of JETS Club made some female pupils decide to join JETS Club. For example, two female pupils described how their friends influenced them to join JETS Club in this way:

> The people who encouraged me to join JETS Club were my friends who were in JETS at this school. They helped me to revise and know more things which I did not know. They also told me that JETS is a good club and they talked about sciences. So I decided that I should also be a member of the club so that I know more like my friends **(Getrude, Duiker High School).**

> As for me, I became interested in JETS through my friends here at school. When I entered grade 10, I stopped doing well in sciences. My grades started going down. So I was like "ah this science thing, maybe I should just leave it to the guys so that I can concentrate on other subjects. May be I will do better because sometimes when we are writing a test it was hard for me to understand the questions". So when my friends came to tell me about JETS Club, they told me the kind of questions that are asked there at the Olympiads, you get to think more and quickly. So I was like "for them it's easy to understand the question when we are writing our science examination, because they are used to thinking quickly when they are doing their Olympiads". I was like, "if I join JETS, I will also do well in my sciences". So I joined JETS and from that time, I started now trying to understand the question clearly and quickly. I have also been able to answer them **(Ellen, Duiker High School).**

Some participants shared that they decided to join JETS Club because of guidance they received from some of their friends as a result of disclosing to them that they had interest in conducting investigations. Since some of their friends knew that JETS Club involved conducting scientific investigations, thus, they directed them to JETS Club. One participant put it this way:

> I have always loved experimenting. So, I asked my friend about a club where they carry out experiments and she told me about JETS Club and I joined **(Patricia, Buffalo Secondary School).**

Other participants said that they joined JETS Club because of the influence of their peers in the same class who perceived JETS Club members to be intelligent. One said:

> What influenced me mostly [to join JETS] were the pupils in my class. They classified JETS Club members as the brainy ones and then there is no way you would want to be left out of that name of being the brainy ones. So, I got inspired and joined JETS so that I could be called the 'brainy one' in JETS Club **(Florence, Buffalo Secondary School).**

4.1.4 Club members factor

Another factor which emerged as having influenced some female pupils to join JETS Club were both former and current members of JETS Club. Some participants said that they were influenced to join JETS Club by former Club members who were rewarded because of their outstanding performance. As a result of their good academic performance, these past JETS Club members were supported to pursue further studies outside Zambia. The participants were of the view that the former club members achieved the excellent performance which earned them accolades through participation in JETS Club activities. Therefore, in view of the fact that they also aspired to receive accolades, they decided that joining JETS Club would help them achieve their ambitions. This finding agrees with that of Agholor and Okebukola (1998) who found that female pupils in Nigeria were motivated to join JETS Club because of awards given to those who performed well in JETS activities. Participants described the influence of club members as follows:

> When we came in grade 8, there was a girl in Grade 11 called Martha. Her sister would tell me that Martha has been in JETS ever since grade 8 and that she has been doing projects. I actually recall seeing her face in one of the *Post Newspaper*. She was put on the education page of the *Post Newspaper.* I was reading that she won a prize and everything she was explaining about JETS from her foundation in grade 8 to grade 12. In grade 12 she was given a chance to do another project and did well. So she got a scholarship to some university in America or in Europe. This inspired me also to join JETS since I also need a scholarship **(Agnes, Buffalo Secondary School).**

> When I was in grade 9, I started watching this programme on television called SMT Tele-quiz. So this boy by the name of Collins from this school won. He was the grand winner. So when I came to this school, I found out that he was in JETS Club and he was the president of JETS, this made me develop interest to join. It also gave me the zeal to become a JETS member because he won a prize and I thought I could also win one. Collins was my big inspiration and I wanted to excel like him **(Ireen, Antelope High School).**

Teachers interviewed supported the view that accolades given to female pupils in JETS Club who perform exceptionally well, made some female pupils decide to join JETS Club so as to be rewarded as well. One teacher put it this way:

> Prizes and certificates given to JETS Club members who do well also attract female pupils to join JETS Club **(Male, Standards Officer for Sciences).**

Some participants submitted that they were inspired to join JETS Club by the good performance of both female and male members of JETS Club in class activities in all subjects, particularly sciences and mathematics. Participants attributed the excellent performance of these club members to their involvement in JETS Club activities. Since they also had the desire to perform well in class as JETS Club members did, they felt that joining JETS Club would enable them accomplish their aspirations too. A study by McLure and McLure (2000) supports the idea of a positive relationship between out-of-class science achievement and in-class science attainment. Some participants put it this way:

> The girls who were members of JETS Club were doing well in class in all subjects. So I thought that I would also start doing well if I joined JETS Club. Hence I decided to join **(Felistus, Eland High School).**
>
> I was not good in mathematics and science. But most of the people who were in JETS were good in mathematics and science in class. They told me that they learnt most of the things in JETS. Because of what my friends in JETS club told me and my desire to do well in mathematics and science, I decided to become a member of JETS Club **(Isabel, Buffalo Secondary School).**

Other participants said that they were inspired to join JETS Club by some members of JETS clubs who made impressive projects. In view of the fact that the projects generated by these club members were inspiring, participants reported that they also developed the desire to engage in such activities so as to come up with projects other people would admire. Since projects were done in JETS Club, they decided to be members. Two of the participants interviewed explained how they were influenced as follows:

> There was a certain point when projects started coming in, people in our class like Malama started doing project work. She did a mathematics project and she actually came out really well. I admired her courage to do a mathematics project and I have such passion for mathematics. So I thought to myself, "If I joined JETS, I can also do something like that because I know I have the capability, I know I am able". So, I joined JETS. This year I did my project because of Malama's influence **(Agnes, Buffalo Secondary School).**

> I decided to join JETS Club because I was inspired by the kinds of projects JETS Club members used to come up with. They were interesting (**Maureen, Duiker High School).**

The findings that some female pupils decided to join JETS Club because of what some pupils (perceived as role models) in JETS Club did or achieved could be said to reflect the vicarious learning component of the Self-efficacy Theory (Bandura, 1986), which posit that the success of other pupils makes one think that she can do it also. This finding is also in agreement with previous studies (e.g., Chimwayange & Davies; Wan, 2006; Welty & Puck, 2001) which found that role models influenced decisions of some pupils.

Some participants disclosed that they decided to join JETS Club because they were verbally persuaded to become members of the club by some of their fellow pupils who were already in the JETS Club. Some were persuaded to join the club by ordinary members while others by leaders of the JETS Club. The club members encouraged participants to join by telling them the value of engaging in JETS Club activities. This finding could be interpreted to reflect the verbal persuasion aspect of the Social-efficacy Theory, which states that verbal persuasion can influence one's decision or choice (Bandura, 1986). Two participants described how some JETS Club members influenced them as follows:

> Martha really inspired me to join JETS Club because she would come to our class and talk to us. She said "join JETS, it is a very good club". She also told us about the advantages that we would get from JETS, i.e., being head of the class, improvement in academic work as well as

> shining in class that I am a JETS member. So I did just that **(Beatrice, Buffalo Secondary School).**

> When I came to this school, JETS executive members were passing through the classes talking to pupils about JETS Club. They explained some of the benefits of being in JETS. I got interested and decided to join (**Bernadette, Duiker High School)**.

4.1.5 Teacher factor

Classroom teachers and those in school administrative positions were also mentioned as being a factor which made some of the female pupils join JETS Club. Participants said that one way teachers influenced them to join JETS Club was through motivational talks they gave in their classes. The motivational talks focused on challenging existing gender norms with respect to participation in scientific and technological activities. They were encouraged by saying that they could also make it in JETS because females were as capable as male pupils. Before the motivational talks given by teachers, some of the participants disclosed that they did not think that they could join JETS Club, because they were of the view that it was a domain for male pupils only, although they had an interest in joining the club. After the talks given by teachers in which they indicated that JETS Club membership was open to female pupils too, and that it would be useful to class work, some participants developed confidence to be members of JETS Club. The motivational talk by a teacher may be interpreted to reflect the liberal feminists perspective. Two participants described the influence of the teachers in this way:

> A teacher came to our class to talk about JETS [Club] where he told us that JETS was not only for boys but girls can also join. So after that encouragement, I followed the teacher and I went to ask him "okay sir, I want to join JETS but I don't know how I can do it being a girl". So he was like, "you do not have to look at how many girls are in the club. You have to take it up for yourself alone. So if you want to be in JETS, you can be. Furthermore, it will help you academically". So, that is how I came to join JETS through my teacher's encouragement **(Francisca, Duiker High School).**

> I remember when I was in grade 10, our teacher of physics used to say "Why is it that, most of you girls do not join

> JETS Club? It is only boys who join". So when I joined JETS, the same teacher was like, "it is good that we can see girls in JETS Club and they want to do something which can help them". **(Loveness, Duiker High School).**

Another group of participants submitted that they decided to join JETS Club because of their teachers who told them that participation in JETS Club activities would assist them in various ways, such as to win an award, and to learn more than they would during formal lessons. Participants further said that teachers encouraged them to join JETS by telling them that their performance in class, particularly in science and mathematics subjects would improve. Since some participants had the aspirations to win awards (such as scholarships), acquire more understanding of science subjects as well as obtain good results, they decided to join JETS Club. This finding that some female pupils decided to join JETS Club because of oral persuasion from teachers, could be said to reflect the verbal persuasion aspect of the Self-efficacy Theory (Bandura, 1986), which posits that pupils may make a decision to participate in an activity or take a subject as a result of oral encouragement from people considered to be important, in this case, teachers. Furthermore, the arguments advanced by teachers to encourage them to join JETS reflect the utility value component of the Modern Expectancy-value Theory (Eccles & Wigfield, 2002). Some participants described how teachers influenced them in this way:

> I was inspired by my teacher. She told me about a girl who had won a prize at a JETS fair through a project and this girl went abroad for further studies. So I decided to do a project so that I could come out victorious and follow the path of this girl. So I started researching on a project. The only way I could make a successful project was through JETS. This is how I got into JETS **(Miriam, Antelope High School).**

> I found mathematics and science tough in class. Our teacher Mr. Muma was telling us that if you want to be good in mathematics and science, you must join JETS Club. Therefore, since I wanted to be good in mathematics and science, I joined JETS Club **(Isabel, Buffalo Secondary School).**

Teachers interviewed corroborated sentiments made by pupil participants that they were attracted into JETS Club by some science teachers, who gave motivational talks on the value of being a JETS Club member. One teacher said:

> Some female pupils decide to join JETS Club because of encouragement from some science teachers. For example, I talked to them [female pupils] that I was a member of JETS Club and this helped me to get into University of Zambia and also built myself confidence. This made some of them join **(Female, Head of Science Department).**

The finding that teachers influenced some of the female pupils' decision to join JETS Club is in agreement with the findings of Walkington (1998), Boe and Henriksen (2011), as well as Welty and Puck (2001), who found that teachers influenced pupils' enrolment decisions.

4.1.6 Media factor

Some participants said that they decided to join JETS Club because of the motivating stories they read in books. As a result of these stories, they were inspired to come up with an invention, which would address some of the challenges experienced by people in life. Since JETS Club is known to provide opportunities for pupils to engage in projects aimed at developing products, intended to solve problems encountered in daily life, they felt that this club was the right avenue for them to come up with something useful to society. One female pupil described how she decided to join JETS Club as follows:

> In a book I read, there was this man who owned a company that comes up with projects to help solve problems being faced by people in developing countries. For example how to produce a seed that would grow faster than expected and other things. I felt that I could learn all these things in JETS and may be later on develop something that could help other people in the world. So I joined JETS **(Angela, Antelope High School).**

Other participants disclosed that they were also motivated to join JETS Club because of what they read in one book, which revealed that there were very few individuals in certain medical fields in Zambia. Since some of the activities in JETS Club provided opportunities for more learning of science subjects, required to enter a medical career, they were of the view that becoming a JETS Club member would give them an opportunity to acquire better understanding of science, perform well and enter their desired medical career. For example, one said

> The thing that motivated me to join JETS was a book that I read called "gifted hands" by Ben Carson who is a neuro-surgeon. I also heard that in Zambia, there are not many neuro-surgeons. So I thought that if they are a few, maybe I can also make a name in the country and get well known if I became one. Since JETS deals with sciences, I got encouraged to join the club so that I could get to know more things since being a neuro-surgeon is not an easy thing **(Lucia, Antelope High School).**

Some participants disclosed that they decided to join JETS Club because of the influence of science documentaries they watched on television. The documentaries showed scientific and technology-based issues which demonstrated creativity (such as changing something from one form to another) , were exciting and in certain cases featured things which were difficult to understand. The creativity demonstrated by the actor in the documentary and the desire to understand some of the scientific and technology issues they saw on science-based television programmes, caused participants to decide to join JETS Club. They were of the view that by joining JETS Club, and participating in its activities, they would acquire skills such as imaginativeness to do what they saw in the documentary as well as acquire knowledge to understand what they watch on television, related to science and technology. Two participants described how they were influenced as follows:

> There is this movie called '80 days around the world' which motivated me. In the movie, there was this scientist who kept on changing things. He was going somewhere in a boat, then he wanted to get where he was going fast , he decided to break the boat and make something like a plane out of the boat. He made the plane and got where he wanted to go. This interested me. When I watched this movie, I started thinking that if that man can be making things, I can also make something new. So I thought that if I joined JETS and learn more about sciences, I can also

> make something. So I decided to join (**Nancy, Antelope High School**).

> At home, I was watching a television programme called 'house' that deals with medical issues. So there was a certain doctor who was talking about a psychopath. There was this woman who when you just touch her, her bones would break.. So I got motivated, I wanted to know more. So I thought that JETS would help me understand these things because it deals with sciences and it covers a wide range of issues. Therefore, I decided to join **(Betty, Antelope High School).**

This finding is in line with that of Boe and Henriksen (2011), who found that media influenced pupils' decisions. However, the finding contradicts the argument advanced by Steinke (2005), that the media also teach female pupils into complying to traditional stereotyped activities. Furthermore, it has observed that some print media strengthen gender stereotypes (Hyde & Linn, 2006), resulting in discouraging female pupils to engage in STEM activities.

4.2 Research Question 2: What benefits (if any) do female pupils acquire from participating in JETS Club activities?

Participants cited various benefits arising from participating in JETS Club activities. They submitted that a major payback for participating in the JETS Club activities was the opportunity to learn science. They said that they were able to acquire scientific knowledge through participating in presentations at other schools and quizzes during regional and national JETS fairs. For example, some expressed the following sentiments:

> When you go to other schools [for JETS activities], let's say you have presentations to make, we learn new things. Maybe you do not know the kind of material that person used to get the information, you ask and they share it to you. So as a result you gain more knowledge and you learn a lot of new things **(Francisca, Duiker High School).**

> I found the quiz a very good learning experience because last year when I was in grade 9, we took part in a quiz at zone level. That side they ask a lot of questions from grade 10 work (science and mathematics). The quiz coordinators

> would teach us things for senior secondary. Even the experience of going there, we learnt a lot from the questions they ask during the quiz **(Beatrice, Buffalo Secondary School).**

Teachers interviewed were also of the view that participation in JETS fairs gave pupils an opportunity to learn more from pupils in other schools as they talk to them and view works done by other pupils. One put it this way:

> They [female pupils] get exposed to a number of ideas as they mingle with others during fairs and also see projects done by other pupils **(Female, Standards Officer for Science).**

Participants refered to the opportunities to ask questions as being most beneficial. They noted that due to the way time-tabled lessons were conducted, they rarely had the chance to ask questions or seek clarification from the teacher. Participants revealed that they felt more free to ask their fellow pupils questions than their teachers. Two participants put it this way:

> You find that in class there are certain things that you don't understand and you ask the teacher, the teacher explains but you still do not understand and you feel ashamed to ask again. So you take such questions to JETS that's where they are explained better. When you are asking such questions you usually go to one of the JETS executive and say help me with this if they do not have the answer they give it to a friend so you don't get ashamed or anything like that **(Cecilia, Antelope High School).**

> You find that some questions you cannot ask a teacher because some teachers are very rude. So if you ask your friend he/she will explain it better than a teacher in class, because we are of the same age group and we understand each other and the challenges that we all go through. So if I had to ask Idah a question, she would actually explain it to me in a way I can understand **(Doreen, Duiker High School).**

Participants also reported that they learnt from other pupils' JETS projects at school level and from projects done by pupils from other schools during inter-schools JETS fairs. Some described this benefit as follows:

> Just within the JETS Club we are able to learn a thing or two just from our friends because let's say I am doing a project in mathematics on this topic and then Malama is doing a project in English, she is able to tell me what she is doing and then I learn a thing or two from her, just like that **(Beatrice, Buffalo Secondary School).**
>
> Last year I was given an opportunity to present a project at a JETS fair. I was deeply encouraged by the different people I met there and there was a lot I learnt from other people's projects. I discovered that you could produce electricity from lemon, also that you could produce petroleum jelly from wax, I also discovered that nitrogen gas could perform a lot of miracles e.g. if you get a soft ball and put it in nitrogen it becomes a solid **(Fridah, Antelope High School).**

Thus, according to responses given by participants, JETS Club gatherings gave opportunities to pupils to learn from one another, which scholars (e.g., Savage, 1999; Naidoo & Savage, 1999) indicate is a good didactic practice. It would seem that pupils in free-choice learning environments learn from one another more successfully than they do from teachers in more conventional teaching and learning environments. This finding echoes the sentiments of Commonwealth Organisation (1995) and Nchesi (2001), who assert that science club activities provide opportunities to pupils to learn from one another.

Participants also found that being a JETS Club member gave them access to learning materials, typically available only to pupils engaged in education beyond the ordinary level. The participants regarded this opportunity positively, as it would eventually prepare them for advanced studies at tertiary level. In connection with this, one participant said:

> JETS Club is helpful to me in that most of the things that we learn in JETS is mostly A-level because, if you are preparing for Olympiads you are expected to read books that are at a level like the university. So you have an overview of what you are likely to find in the university **(Idah, Duiker High School).**

Some teachers interviewed also supported the benefit advanced by some participants that participation in JETS Club activities prepared female pupils for advanced studies beyond high school level. They said:

> Participation in JETS activities enables female pupils to acquire good foundation for further studies. They succeed at college level and university level **(Female, Regional JETS Organiser).**
>
> They [female pupils] acquire good background to A-level materials because what is normally covered in JETS Club is beyond O level material especially in Olympiad **(Male, JETS Club Patron).**

Participation in JETS activities enabled participants to acquire knowledge and skills which they would otherwise not have acquired through attending time-tabled science lessons only. In essence, JETS activities offered participants enhancement opportunities. This findings agrees with those of Agholor (1994), Eastwell and Rennie (2002), as well as Misra *et al.,* (2013). One participant put it as follows:

> In some subjects it is not always that a teacher can teach everything in every topic. So you get to learn the things that have been left out during lessons from JETS **(Naomi, Buffalo Secondary School).**

Participation in JETS activities such as quizzes, research and projects helped participants in class-work. In other words, there was a carry-over effect from science-based extra-curricular activities to time tabled science activities. This finding echoes that of McLure and McLure (2000), who found that there was a positive link between out-of-class and in-class science achievement. Similarly, Jones (1997) found that interest in science-based extra-curricular activities was carried over to timetabled science lessons. They described this aspect this way:

> It also helps in class work. I took part in the quiz and I was studying to prepare for the quiz. What I was doing in the quiz last year helps me right now in chemistry, physics and biology because I had an idea last year and that has stayed in me. I am actually able to understand quickly in class because of what I did last year **(Beatrice, Buffalo Secondary School).**

> The benefit of JETS Club is that I get to do a lot of research. Through this I learn a lot from JETS. It also helps me in my school work and do better in class **(Linda, Buffalo Secondary School).**

> I think that it has benefited me in a way because in grade 10 my performance in chemistry was not bad but average. Sometimes I would do well and other times it would be average. But after I did a project in senior chemistry, it really helped me to improve my performance in chemistry. Also, I did not like chemistry before I did a project but afterwards, I found that it was such an enjoyable subject in a way (**Daisy, Buffalo Secondary School).**

Participants also said that JETS Club activities helped them to comprehend mathematics better, an essential tool in the learning of science subjects, which a number of pupils had difficulty understanding prior to their JETS experiences. One participant said:

> JETS has helped me a lot especially in mathematics, I always thought mathematics was a very hard subject but then there are times when you hear something twice or more than twice, you get to understand it. So when you learn something in JETS and when you hear it from the teacher, you have an idea. So you catch up fast (**Florence, Buffalo Secondary School).**

Improved performance of female pupils in class as a result of their involvement in JETS Club activities, was also alluded to by teachers interviewed. They claimed that JETS Club activities gave them opportunities to study widely. They explained the good performance as follows:

> They perform well in science subjects because they read a lot **(Female, Regional JETS Organiser).**

> They become good performers in class in all subjects because JETS involves a lot of reading and research **(Female, Science Lecturer).**

Participants cited improvements from low to high marks in their examination performance as a result of their involvement in JETS Club activities. This finding is consistent with those of Reeves (2008), Nchesi (2001) and Agholor (1994), who found improved grades among pupils who participated in science-based extra-curricular activities. One participant described the enhanced attainment as follows:

> In grade 10, I was very bad in chemistry and physics but when I look at my grade 10 term 3 results, I got 90 per cent in chemistry, that was from 53 per cent to 90 percent and in physics I got 87 per cent. So I think my grades have really improved. Even in mathematics in grade 10, I got 65 per-cent and this term I got 79 per-cent (**Idah, Duiker High School).**

Improvements of examination performance in science subjects due to participation in JETS activities by female pupils was also supported by teachers interviewed. Some of the teachers claimed that improvement in examination results was not only restricted to science subjects, but to other non-science ones as well, such as English. They said:

> Female pupils who participate in JETS Club activities perform well in SMT subjects in examinations **(Female, Standards Officer for Science).**
>
> Participation in JETS activities improves female pupils' performance in science and mathematics as well as in English because of research they carry out improves their vocabulary. Requirement to write reports improves their composition writing skills. In most cases, girls who have performed well in grade 9 and grade 12 examinations were JETS members **(Male, JETS Club Patron).**

Participation in JETS activities was also said to be of great value by participants, in the sense that it gave them an opportunity to acquire knowledge regarding different types of science-based careers, that would enable them to make informed choices when they will be required to do so. Similar findings have been reported by Molly and Aronson (2006). One participant said:

> The other thing is that JETS really helps us to choose our careers. Like for me the time that I came to this school, I just used to dream of being an engineer. Since there are a lot of types of engineers, through my being in JETS I was able to know what type of engineering is good for me. It is even good for those people who are just in school and they do not know what they want to become, I think they can

> join JETS and it can help them choose what they want to become **(Ireen, Antelope High School).**

Participants indicated that participation in JETS Club fairs held at regional and national levels provided them with opportunities to meet with other pupils. Regional JETS fairs may involve 10-15 secondary/ high schools while a national JETS fair involves pupils from schools all over Zambia. Thus, these fairs give them opportunities to meet and mix with pupils from other schools and, in so doing, acquire social skills, share information and enhance their knowledge. Some participants said:

> During fairs, we are also able to interact with people from other schools. What they learn there, we are able to exchange ideas **(Beatrice, Buffalo Secondary School).**

> For me JETS has really been a good thing because I have been able to interact with many people and I have learnt a lot **(Hilda, Eland High School).**

Interaction with other pupils gave participants the opportunity to acquire interpersonal skills. For example, some respondents claimed that participation in JETS Club activities taught them to respond in a friendly manner, to requests from other people. They became willing to exchange ideas and assist each other where one had difficulties. Some participants put it this way:

> When we visit other schools we learn the way they associate that side. Also when you learn the way they associate with different types of people, you have a wide range of how to associate with different types of people **(Ireen, Antelope High School).**

> It also has helped me to relate better with other people when they come to ask me about what I might know and as I find out what I do not know from other people **(Daisy, Buffalo Secondary).**

Participants also mentioned development of thinking capacity as one of the pay backs of participating in JETS Club activities. This finding is also in agreement with those of Reddy and Savage (2004), Nchesi (2001) and Woolnough (2000), who found that there was improvement in the thinking capacity of pupils who participated in science-based extra-curricular activities. This claim was also supported by teachers who held the view that it encouraged them to think beyond their usual limit of thinking. They stated:

> The thing about JETS is that you are able to think wide and think big. Everything is possible, nothing is impossible. So if you just put determination and all your efforts together you can be able to achieve something, achieve everything you want to achieve in life **(Ireen, Antelope High School).**

> JETS has improved my thinking capacity. These days at home when something needs to be done, my mum will always say 'where is Bertha? She is the one who thinks fast' **(Bertha, Eland High School).**

> JETS activities encourage female pupils to think outside the box. Thus, it improves their thinking **(Male, Science Teacher).**

Some participants cited improved self-expression as one of the benefits of participating in JETS activities. They indicated that their ability to put their views across to other people had been enhanced. Improved communication skills among participants of science-based extra-curricular activities had been reported by previous research (e.g., Heany, 1995; Woolnough, 2000; Nchesi, 2001). In the current study, some of the participants expressed this benefit as follows:

> As a result of being in JETS Club, I am able to express myself in public and explain things to other people (**Grace, Buffalo Secondary School**).

> I have learnt how to communicate with people. And I now speak good English because obviously if you present your project, you have to tell the judge more about your project. Thus improving your communication skills (**Doreen, Duiker High School).**

Some teachers interviewed also supported the assertion that participation in JETS Club activities improved female pupils' articulation. They said:

> Involvement in club activities improves their ability to express themselves orally through explaining their projects to other people **(Male, JETS Club Patron).**

> They develop communication skills through paper presentations **(Female, Standards Officer for Science).**

Another benefit of participating in JETS club activities brought out by participants was the development of self-confidence. They said that they became more confident in expressing themselves as well as presenting something in front of other people than they were before they got involved in JETS activities. Mannion and Coldwell (2008), Clewell and Darke (2000), Actua (2008b), Agholor (1994) as well as Vandell, Pierce and Dadisman (2005) found that pupils who participated in science-based out-of-school activities developed confidence. Regarding this aspect, participants expressed the following sentiments:

> It [participation in JETS activities] has increased my confidence. When we went for the JETS fair, I was really confident in explaining my project. But before I started doing projects, I was not confident **(Grace, Buffalo Secondary School).**

> JETS is also beneficial in a way that you develop self-confidence because when it comes to, for example, teaching, you go there in front and you start teaching. You have that confidence. So because of that, I have also had confidence to present information to you because I have gained that confidence in teaching others **(Ellen, Duiker High School).**

Development of motivation to study hard was also given by some participants as one of the advantages of participating in JETS Club activities. They explained that they were motivated to study hard and widely, so that they could participate actively during JETS Club activities. Other participants said that they were also encouraged to read hard because of the competition which existed in certain JETS Club activities, such as the desire to be the best in tests among club members or beat boys. Two of the participants put it as follows:

> Participation in JETS Club activities gives us the morale to study because when we go for a JETS meeting, we are free to talk. Like when there is a topic for discussion, everyone will be contributing and asking questions. You will just feel out of place when you are not answering, you are just idle. Therefore, you will want to study so that the next time

> you go for a JETS meeting, you will be able to answer questions or participate **(Nancy, Antelope High school).**

> When we go in JETS, we all look at ourselves as being the best, so there is stiff competition amongst ourselves when it comes to class work. So by that stiff competition I am forced to study even more because I want to compete with someone. So that way, I find that I am even doing better in class than I was doing before. In short, we compete among ourselves. So because of that competition, we force ourselves to study. Let's say we are writing a test in JETS next week, all of us will want to get the best, so we are going to force ourselves to study and the good part of it is that JETS is dealing with the subjects we do in class as well. So when we are studying for the JETS tests or quizzes we are also covering something for the class (**Francisca, Duiker High School).**

Teachers also submitted that female pupils in JETS Club were encouraged to study harder so that they could, as they wanted compete with boys in the club as well as beat them intellectually. One teacher said:

> JETS Club gives female pupils an opportunity to compete with boys in SMT subjects. Because of this competition, they are motivated to read widely and harder **(Female, Standards Officer for Science).**

Another advantage of participating in JETS Club activities advanced by participants was the development of self-reliance. Participants claimed that as a result of their involvement in JETS Club activities, they had become self-reliant with regard to sourcing information. They no longer depended on their teachers to provide information, instead, they searched for information themselves. A similar finding with respect to independence has been reported by Nchesi (2001) among girls who participated in science club activities. In situations where schools have no or have inadequate science teachers, acquisition of the ability to do things on their own is good for them. Two participants expressed this benefit as follows:

> Participation in JETS activities helps you to become dependant on yourself when it comes to studying. For instance, instead of just waiting for the teacher to teach,

> you can just teach yourself **(Angela, Antelope High School).**
>
> In JETS, I have learned how to do something on my own. Like when I am given something in class, I am able to research on my own without depending on my teacher **(Grenada, Eland High School).**

Some participants indicated that because of their involvement in JETS Club activities, they were able to do certain things on their own outside the school. For example, they could work on faults at home without calling other people to come and do it. This means that there was a carry-over effect of the skills and confidence they acquired in JETS activities to home. One participant said:

> The other thing is that I are able to rely on you, once I learn something in JETS and have a problem at home or want to fix something, I can fix it. I can't call someone to fix it for me as I become more responsible at home **(Harriet, Antelope High school).**

The assertion by participants that participation in JETS Club activities made them become independent was also supported by some teachers interviewed. They stated that:

> Some female pupils acquire a sense of responsibility to do things on their own and without being supervised **(Male, JETS Club Patron).**
>
> They develop ability to work independently **(Female, Standards Officer for Science).**

Another positive aspect attributed to participation in JETS Club activities by some female pupils, was in terms of assisting them to focus on tasks they were engaged in, such as doing a project or studying. This finding is consistent with that of Vandell, Pierece and Dadisman (2005), who found that participation in STEM-related extra-curricular activities developed pupils' focus. Some participants stated that their resolve to succeed in whatever task they were given had been enhanced by their participation in JETS Club activities. Nchesi (2001) also reported enhanced determination among girls who were engaged in science club activities. In the present study, some participants put it this way:

> JETS has helped me to be focused. Before that, I was really not focused. But when I did a project, I was able to focus on what I was doing. If it is studying, I will study. When I was doing a project, I focused on getting it done. After doing the project, I am able to use that ability to focus on my school work as a grade 12 **(Mary, Buffalo Secondary School).**

> JETS has also increased my determination. When doing my project, I developed determination to continue and to finish it as well. Before that I was not determined in any way to do any anything **(Grace, Buffalo Secondary School).**

One of the teachers interviewed also supported the view that participation in JETS Club activities taught female pupils to be persistence until a task is accomplished. He said:

> Engaging in JETS activities such as projects teaches them not to give up easily because they [projects] do not work out easily (**Male, JETS Club Patron).**

Participation in JETS Club activities developed some participants' capability to manage stressful and challenging situations such as when things do not work as expected as well as preparing one for possible upcoming challenges. Participants acquire capability to manage challenges through working on projects which did not work out on the first attempt. Two participants put this issue this way:

> [As a result of participation in JETS activities] I am able to handle pressure in the sense that when I am carrying out a project, sometimes the project does not work out and I am forced to think in a short period of time of how to make the project work **(Bernadette, Duiker High School).**

> JETS also prepares me for future challenges because if I am able to face a challenge in JETS now, maybe I will meet a similar challenge in future, I may be able to handle it. This is because I may remember something from the way I handled the earlier one (**Catherine, Duiker High School).**

Participation in JETS activities was also reported to be beneficial in the sense that it trained participants to accept defeat in life and move on to achieve success. This finding is similar to that of Vandell *et al.,* (2005), who found that participation in STEM-related clubs developed pupils' ability to persist in competitive scenarios. One participant described this benefit in the following way:

> I have learnt to accept defeat in competitions because I can say that I lost last year. Although it was kind of hard for me to accept, I got to understand that things do not always work. Next time, I will do something better **(Agatha, Duiker High School).**

The benefit of participating in JETS activities regarding accepting loss or defeat given by participants was also alluded to by teachers. One teacher said:

> They [female pupils] learn how to manage disappointment when they have lost in a competition **(Male, JETS Club Patron).**

4.3 Research Question 3: What challenges (if any) do female pupils encounter as a result of joining and participating in JETS Club activities?

One challenge some participants expressed was the disapproval of their joining of JETS Club by some of their family members. For example, one participant disclosed that her father demonstrated an off-putting attitude towards her when she informed him that she had joined JETS Club. This finding does not agree with that of Blattel-Mink (2002) who found that fathers more often encourage their daughters to engage in science-related extra-curricular activities. One participant expressed her father's negative response in the following way:

> My dad was disappointed when I told him that I joined JETS Club. He said "I want you to follow my footsteps and become a lawyer like me". So he was like 'no' that is a bad thing to do. Just join debate **(Naomi, Buffalo Secondary School).**

A number of participants also revealed that their brothers reacted negatively over their decision to join JETS Club. Participants were of the view that their brothers did not approve their decision to join JETS because they (brothers) believed that, they (sisters) were competing with them by deciding to join a club considered to be for boys. One participant put it as follows:

> My elder brother was not too happy with the idea of me joining JETS. He came and said "what is wrong with you? Don't you know that JETS is for guys? Why do you keep on bringing in competition?" And I was like, "are you scared that a girl will beat you?" Then he said, "No, I know I am better than you". Then I was like, "Well I guess so, unfortunately, the results so far are not in your favour". He then said "whether you try your best, whether you put in all you have, JETS is for guys" and I said "well if it is a guys thing, I will be there because I know I have what it takes". So from that moment I have been putting in my best so that I can challenge him and make him feel bad **(Agnes, Buffalo Secondary School).**

Some female pupils said that their brothers questioned their capability to undertaking tasks done in JETS Club. One respondent put it as follows:

> The reaction from my brother was very bad. When I told him that I had joined JETS Club, he was like "what can you do? I give you this simple mathematics you fail to solve". He even went on to tell grandmother but my grandmother was impressed and I told him that even if you tell me that, I am still going to do it **(Bertha, Eland High School).**

Negative attitude towards female pupils' joining of JETS Club was also displayed by some of the sisters of several participants. Two participants described how their sisters opposed their joining of JETS Club as follows:

> My other sister started to discourage me saying you are not good in mathematics and sciences. She told me that for me to be in JETS, I had to be on top of the class and getting distinctions in everything **(Lillian, Eland High School).**

> My elder sister discouraged me saying, "No! JETS is for very intelligent people. You cannot go there, you will be bored, and stuff like that. Join something which is fun like music club and thing like that" **(Getrude, Duiker High School).**

Some participants reported that some of their uncles opposed their decision to join JETS Club. One participant explained that her uncle did not approval her decision to join JETS, because he did not want her to get into detailed study of science which might make her tend to think that there was no God. Another participant said that her uncle did not like her to join JETS Club because he took it as being a competition with his children. One participant expressed her uncle's reactions as follows:

> My uncle who is a pastor told me that sciences are not so good because most scientists are atheists, they do not believe in God. He told me to be careful and also that I should not go too deep in studying sciences and should not ever think that God does not exist. He was scared that I might become an atheist **(Dorothy, Antelope High School).**

Another challenge some of the participants experienced is that some of their peers, did not support their decision to join JETS Club. For example, two participants described how their friends made efforts to discourage them as follows:

> They [friends] told me that in JETS you are doing things that are higher than your level and you come to class you are doing another level. So you get mixed up. They also told me that JETS will just be taking my time especially when it is time for projects because we take time to prepare the projects. Most of the time, I will be moving up and down **(Francisca, Duiker High School).**

> Some girls would say JETS is for boys only. So when I first told my friends that I had joined JETS, they were like "are you going to manage to withstand the pressure that is in JETS? You have to think a lot when coming up with projects". They were encouraging me to stop JETS and join another club. I told them that this is what I want. I am supposed to follow what my heart tells me **(Grenda, Eland High School).**

This finding is in agreement with that of Harding and Apea (1991), who found that friends of females who were studying engineering, discouraged those who were pursuing engineering programmes by telling them that women should not pursue engineering because it not considered as a woman's career. This is also in line with the observation by Kelly (1988), who observed that female pupils who have interest in science are unlikely to have a network of friends who have interest in science-related activities.

Although some participants experienced disapproval regarding their decision to join JETS Club, from their parents, sisters, brothers and uncles as well as from friends, they did not change their minds. They were determined to hold on to their decision to be members of JETS, regardless of negativity from other people. They were of the view that they had made the right decision. This finding is in agreement with that of Modi, Schoenberg and Salmond (2012), who found that discouragement made some girls stronger and more motivated to prove wrong, some individuals who questioned their abilities. Similarly, challenges experienced by females in the engineering profession have been reported to have motivated them to continue with the engineering area (Buse, Bilimoria & Perelli, 2013). In the present study, some expressed their determination as follows:

> I always take a firm stand for decisions I make and when I decide to do something, it doesn't matter what other people think about it as long as I think it will build me up, I go for it. So I went for JETS Club against what others said (**Juliet, Duiker High School**).
>
> I do not give up easily just because it is a guy. So I was like, I will take up the challenge even though he thinks that I won't manage. I will prove that although being a female, I can do it. This is why I continue to be a JETS member **(Celina, Buffalo Secondary School).**
>
> [When I make a decision], I do not give up easily. I do what I want to do, that is join JETS Club **(Dorcus, Eland High School).**

Negative attitude of some boys in JETS Club towards female pupils who cross gender barriers into JETS Club, was also given as one of the challenges of being in JETS Club by some of the female pupils who participated in this study. The boys in JETS questioned the presence of female pupils in a science-based extra-curricular club, and some did not even want to relate with female club members. Regarding this aspect, two participants said:

> Boys usually feel like we are stepping into their territory when we are interested in such things like JETS. They even ask you, "a girl in science? It cannot happen". So even boys' mentality sometimes discourages us because if you hear certain things a lot of times, you can end up thinking like that yourself and you get discouraged **(Angela, Antelope High School).**

> Some boys do not like associating with girls. They term themselves as ‘monks’. So you find that even if that boy is good at let’s say physics, he can’t assist you as a girl because he is a monk. You find that he knows something and you just want to widen your knowledge, but you will be limited because that person cannot associate with girls **(Ireen, Antelope High School).**

Some teachers also supported the sentiments advanced by some participants that one of the challenges female pupils experienced, came from male pupils in JETS Club, who did not think that girls should be in the JETS Club too. For example, one teacher said:

> Boys in the club intimidate girls. They dominate the club in terms of numbers and participation. There is also verbal intimidation in which ideas from girls are not readily accepted by boys **(Female, Standards Officer).**

This kind of behaviour by male pupils could be attributed to gender stereotyping of science, mathematics and technology as domains for boys (Erinosho, 2001a; Okebukola & Agholor, 1991).

Participants also cited the unwelcoming attitude of some of the old JETS Club member as one of the challenges which they encountered. Two participants described their experience in this way:

> When you come in there as a new comer, there is no introduction. You have to know how you will get along with the people. When you come into JETS, you are on your own. Particularly the boys were not welcoming, but I wanted to be in there. So I stayed on **(Agatha, Duiker High School).**

> As for me the environment [in JETS Club] was quite harsh. The grade 12s never used to associate with anyone who was lower than their grade **(Rachel, Buffalo Secondary School).**

Some participants experienced problems in trying to fit into the JETS Club activities. One participant described the unwelcoming behaviour of some of the JETS Club members as follows:

> The challenge that I faced was fitting in the JETS Club. The club had pupils who had formed groups that were only working together and once you join, it was very hard to fit in because you find that everyone was in a certain group and they did not pay attention to new members (**Ireen, Antelope High School)**.

However, the negative attitude of some of the senior members of JETS Club did not discourage some participants from being club members. They were determined to be in the club as the statement below from one participant illustrates:

> But as time went on, I made up my mind that even if they told me that, they would not bring me down. This is because I am determined and focused on my future. Even if they said things like "you are a '*zeze*' (new comer) or you are not suitable". I would say " no, you are wrong. We are all here for one thing, which is to learn and develop our understanding" **(Rachel, Buffalo Secondary School).**

Another challenge which participants experienced was balancing time between engaging in JETS activities and other activities which they also considered to be important. Participants cited instances when they found it difficult to divide their time between attending extra lessons to prepare for final examination and preparing for the JETS quiz competition. Other participants reported challenges with respect to apportioning time between JETS activities, household duties and core-curricular activities. This finding is similar to the findings of Harding and Apea (1990) as well as Gerdes (1995), who found that females in science-based careers experienced difficulties in balancing work and family demands. In the current study, some participants said:

> The most challenging thing which I have encountered was last year when I was taking part in the quiz, I was in an examination class (grade 9) [and] during study, we would learn so that we are able to finish the syllabus and then let's say after 21 hrs we are given time to study further (just the examination classes) [and] my friends were excelling in

> school work as for me I was slightly behind because of [JETS] quiz. It was hard **(Beatrice, Buffalo Secondary School).**

> As a girl child, we have a lot of responsibilities not only at school but we are expected to do more even at home. So you find that if you do not have a maid at home to do everything for you, you have to divide out time for studying, divide your time for JETS and you also have to divide your time for home chores (**Doreen, Duiker High School).**

Other participants were of the view that time allocated by the school management to JETS activities was not enough because of the nature of some JETS activities. One participant put it as follows:

> There is very little time allocated to JETS Club activities. Just one hour in a week which is not enough for serious activities **(Angela, Antelope High School).**

Participants also stated that initiating and developing a good project was difficult because it required a lot of imagination. In some cases, the challenge arose from the fact that things did not work out as expected. Some that:

> Coming up with projects is not easy. You might want to do this project and they might tell you no these materials are not easily found. It is hard **(Catherine, Duiker High School).**

> Sometimes a project did not work out in the manner I thought it would **(Felistus, Eland High School).**

Another challenge cited by participants relating to projects were negative comments made by other pupils, in cases where one came up with a project that was not impressive to them. Other pupils were negative about it because of their lack of understanding of the fact that, a lot of things they perceive to be impressive came from very simple things through creativity. One participant articulated this challenge as follows:

> There are certain projects people will look down on, because of the title, for example banana. You look at a banana and a person will be like “What can a banana do? It is just a fruit, you eat it and then you forget”. Just to discourage you they would look at it and say that project won’t do anything. Why are you even doing this? You are just wasting your own time. You won’t even come up with any prize or as you do the research they will be there to tell you that, “Is this all you have and you think you will get anything from this?” **(Agnes, Buffalo Secondary School).**

This kind of discouragement not only came from some pupils but from teachers too. Regarding this issue, one teacher said:

> Female pupils were also discouraged by some teachers who say that this project is not workable **(Male, JETS Patron).**

Participants also indicated that JETS Club activities were not adequately supported by the school management in comparison to other extra-curricular activities such as sports. This made it difficult for pupils in JETS to do what they were expected to do, such as attend JETS fairs or acquire materials they needed in order to carry out their projects. Two participants claimed that:

> Most of the time JETS Club is not considered. They do not support us. They support clubs like debate and drama. So sometimes us pupils, we get discouraged because most of the things are done by us and if we do not do anything, which means nothing will be done **(Gloria, Antelope High School).**

> There is very little support from the school administration in terms of financing JETS activities. They would prefer sports to JETS (**Nancy, Antelope High School).**

The sentiments expressed above by female pupils were echoed by teachers. One teacher put it as follows:

> Management support is a critical issue. At times school managers would not see need or should I say, they seem not to see need in supporting activities such as JETS Club **(Male, JETS Club Patron).**

Furthermore, some participants disclosed that they were not adequately supported by JETS Club patrons. This made it difficult for them to make consultations on projects and for them to travel outside the school because they lacked the company of patrons while others always complained of being busy. Some participants also claimed that some of the patrons were not approachable, thus pupils found it difficult to consult such teachers. Some participants said:

> The patron may not really help you on what you should do about the project, and what maybe wrong with it. They will just come and analyse it at the end and be told "no you can't present it. It is wrong." This is discouraging in that it makes you start thinking that you won't want to research on anything next time because may be you know they will tell you that you cannot present it **(Cecilia, Antelope High School).**
>
> The other thing is lack of support from the patrons. You find that you want to go for a trip to another school, the patron might be busy and so you are not allowed to go. The interest for participation really reduces **(Ireen, Antelope High School).**

The assertion that female pupils did not get adequate assistance from JETS patrons on projects was affirmed by some teachers who participated in this study. Concerning lack of support from patrons, they submitted that:

> Some female pupils receive very little help or guidance from teachers to help them improve their projects **(Male, JETS Patron).**
>
> In some cases, female pupils lack motivation from club advisors. They tell girls that you cannot manage **(Female, Regional JETS Organiser).**
>
> Teachers are not willing to provide guidance to pupils **(Female, Standards Officer for Science).**

Participants also complained of biasness on the part of some patrons. They claimed that some patrons favoured pupils from their classes while some of them paid more attention to club members who were perceived to be good. They also indicated that club members considered to be of low cognitive level were not motivated, in comparison to those perceived to be intellectually good. Some participants expressed their concern as follows:

> The patron encouraged and supported club members from his class and made bad comments on other members not from his class **(Doreen, Duiker High School).**
>
> Club members considered to have low ability are usually side lined by teachers. They concentrate on those who they consider to have high ability **(Bertha, Eland High School).**
>
> There was lack of motivation from patrons/matrons to pupils who were perceived to be not so good but always concentrated on those who were good **(Beatrice, Buffalo Secondary School).**

Other challenges which participants brought out were complaints they got from teachers who were not associated with JETS Club activities. The participants stated that when they did not do well in their subjects, they received negative comments which touched on their participation in JETS Club. With regard to this aspect, one participant said:

> Some teachers not involved in JETS activities complained when you failed their subject especially if you were in JETS Club. They were of the view that we wasted time in JETS activities which they considered as not being useful **(Felistus, Eland High School).**

Accessing information to get ideas on possible projects was also cited by some of the participants as one of the challenges which they encountered. Participants claimed that it was difficult for them to access information that would help them with project work because most schools did not have well-stocked libraries. One said:

> We had a problem to find information we needed to obtain ideas on projects because the school library was not well-stocked with reading materials on science, technology, engineering and mathematics **(Miriam, Antelope High School).**

A similar sentiment was also expressed by a teacher. She said:

> Literature review is a big problem. Internet does not function well. Even printed materials are not available **(Female, Regional JETS Organiser).**

Participants also cited lack of materials for use in projects as one of the challenges. They argued that schools did not provide materials to JETS Club members who wanted to do projects, a situation which made it challenging to engage in project work. They claimed that in some cases, they had to use the little money they had to procure materials. One participant related this challenge as follows:

> We have had challenge of chemicals and apparatus to use for our projects. Sometimes we have to go out of school to do our projects and in some cases use our own money to buy materials **(Loveness, Duiker High School)**.

The sentiment above was also echoed by teachers who said:

> One of the challenges female pupils in JETS encounter is availability of materials for certain projects **(Male, JETS Patron).**
>
> Lack of or inadequate material resources to carry out projects is one problem JETS Club members encounter **(Female, Standards Officer for Science).**

Regarding lack of materials for use in JETS activities, one teacher observed that JETS Club was one of the voluntary activities and therefore some school managers were of the view that there was no need to release funds for this activity. He put it as follows:

> Schools are not very much willing to spend especially for these seemingly voluntary activities **(Male, JETS Club Patron).**

Another challenge female pupils advanced was the low numbers of female teachers involved in JETS Club activities. They had observed that most of the teachers in the position of JETS Club patrons or in some ways involved in JETS activities were males. This situation meant that there were no female role models who could inspire the female pupils within the school. Role models play an important role in raising aspirations (Dimitriadi, 2013). One participant said:

> Three-quarters of JETS patrons are males, as a result boys are more involved in JETS activities than girls because there are no female teachers to motivate girls. Female teachers never join as they claim to be busy **(Grace, Buffalo High School).**

The assertion above by one participant was also alluded to by some teachers. One said:

> Some [female pupils] lack role models. For example, among the JETS organisers, there are very few females **(Female, Lecturer).**

Participants also complained about the way adjudicators were appointed and the way the adjudication process was done. They argued that this was a challenge in the sense that there was unfairness in the way the adjudication was being done, and some of the regulations governing the fair were ignored . One participant had this to say regarding this issue:

> At one regional JETS fair, most of the adjudicators were teachers from the same school which hosted the fair. During adjudication, they were biased towards pupils of their own school. Furthermore, as far as I am concerned, only one pupil is allowed to present a project from one particular school, but for Kanga Girls, you would find may be five pupils presenting projects in one category. The adjudicators acted like everything was all normal **(Daisy, Buffalo Secondary School).**

In connection with the perceived problem of unfairness in the adjudication process, one participant proposed that neutral adjudicators should be used by bringing them from somewhere else. She put it this way:

> We would like that they exchange the judges, those from this province go to another province and another province's judges come to this province for fair judgement because it is not really fair for some of us. We really put effort and we get nothing **(Grace, Buffalo Secondary School).**

The sentiments expressed by some female pupils were echoed by one teacher who said:

> There is lack of qualified adjudicators. Those who are there are bias as a result they demotivate pupils and patrons **(Male, JETS Club Patron).**

Making a presentation during JETS fairs was also cited as a challenge by some of the participants. They said that they found it intimidating to present information before large numbers of different kinds of people. In some cases, negative remarks from some people on the presentation made the problem worse. One put it this way:

> Fear of standing in front of the house presenting to a large number of different kinds of people; such as teachers, parents and pupils. Furthermore, discouraging comments after presentation in certain cases make this process much more scaring **(Ireen, Antelope High School).**

Some participants also complained about the quality of awards that were being given out to those who performed well particularly at national level. They stated that they were not inspiring considering the level at which they were being given. One participant stated:

> The prizes were not that impressive at the national level. This year, we got some exercise books. They are not really motivating to some people especially at this level **(Daisy, Buffalo Secondary School).**

Competing with friends was cited as one of the challenges by some of the participants. They indicated that they found it uncomfortable to compete with their friends in the same school in projects. In connection with this, one participant said:

> The biggest challenge for me was competing with my friends in the same class. We were fighting for the same position. It was really difficult in that may be you found her in the category and then you also say I am in the same category as well. It would really look like you want to compete. You look selfish at times and it's really difficult **(Mary, Buffalo Secondary School).**

This finding is similar to that of Clewell, Anderson and Thorpe (1992), Rosser (1990) as well as Gatta and Trigg (2001), who assert that female pupils did not like an environment where they had to compete with each other.

Learning things that were above their level was cited by some of the participants as one of the challenges they encountered in JETS Club. They further stated that other pupils used this aspect to discourage them from being in JETS Club, saying that they were wasting time learning things which would not be examined. In Zambia, good performance in the examination is considered as very important, because it determines what one will do in future. Thus, this concern. One participant said:

> In JETS, we cover material that is more advanced than the normal syllabus we follow in time-tabled lessons. Therefore it is a bit difficult for some of us to understand. Some of our friends tell us that we are wasting time learning things that will not come in the examination **(Dorcus, Eland High School).**

Missing lessons when participants were finalising preparations for JETS fair and also when attending a district or regional JETS fair was also given as one of the challenges participants encountered. Participants complained that they found it difficult to catch up when they had missed lessons.

Another challenge some participants cited relates to losing in competitions. Participants indicated that they found losing a bad experience. One participant said:

> It is challenging when you lose **(Bertha, Eland High School).**

The challenge of losing by female pupils was also echoed by one teacher as the statements below indicate:

> Pupils spend a lot of time working on a project and when it does not work or win, it is very discouraging **(Male, Science Teacher).**

However, one participant considered losing from another perspective, that is creating more learning opportunities. She put it this way:

> On the part of losing, it is not really a challenge. I would say it is an opportunity to learn more. You may find that you try out something for the first time and then it does not work out and you want to back down. That is not the way it is. You have to strive even harder for you to get what you want **(Hellen, Duiker High School).**

4.4 Research Question No. 4: What do female pupils in JETS Club think might have influenced most female pupils not to join JETS Club?

The issue of some female pupils dropping out of the JETS Club in the light of the challenges presented, was not discussed with participants during group interviews. However, what the researcher sought from participants were their views regarding why some of the female pupils decided not to join JETS Club. Below, are the viewpoints.

One cause of not wanting to join JETS Club cited was that JETS was not considered as a club for female pupils. In this regard, participants stated that they were of the view that most female pupils did not join JETS Club, because female pupils themselves regarded JETS as a club for boys. Two participants put it this way:

> Most female pupils think JETS Club is a club for boys because most of the things that are done like making projects are what most boys would want to do. So, I think that this also discourages female pupils from joining the club (**Elinah, Buffalo Secondary School).**
>
> I think they believe in those old beliefs that there are certain things that boys should do and there are certain things that girls should do. So they think that JETS is a club for boys. Therefore they distance themselves from JETS **(Albertina, Eland High School).**

The perceived difficult nature of tasks JETS Club members are expected to engage in, was cited by participants as a possible reason why some female pupils did not join JETS Club. Some participants expressed their views as follows:

> In most cases what makes most girls not to join JETS is that they think things we do in the JETS Club are too hard for them. They find it difficult to start thinking of researching, reading a lot and stuff like that **(Juliet, Duiker High School).**
>
> Most of the girls say that mathematics and science are difficult. They are only for boys. Since JETS involves mathematics and science activities, they consider it to be difficult. So I think that is what makes them keep away **(Cynthia, Eland High School).**

Some participants were of the view that some female pupils did not join JETS Club because their future career aspirations were not in science-based areas. Thus, they did not see the value of participating in JETS activities. In connection with this view, one participant said:

> Girls say "what can biology, chemistry and physics do in my life? What if I want to do journalism? I have nothing to do with biology. So what is the whole point of joining JETS?" **(Bertha, Eland High School).**

The perception held by some of the female pupils that science education was of no value to them has also been reported by Ekine and Abay, (n.d.). They claim that this kind of thinking arise from the cultural expectations that the major role of female pupils is to look after children as a mother and the husband as wives.

Lack of self-confidence was also thought to be a reason why some of the female pupils did not join JETS. Some participants stated that some of the female pupils who did not join JETS Club had a belief that they could not do activities expected of them in JETS Club successfully. Some of the participants expressed this belief as follows:

> It is because of lack of self-esteem in that a lot of girls look down on themselves. Even before they do something, they have already failed and so there is no need to try if you think you have already failed. So that's how I look at it from my point of view **(Olipah, Eland High School**).

> I think most girls lack confidence in themselves. A lot of them have low self-esteem in that they do not believe in themselves. The say to themselves that if they were to go into JETS, there is nothing they can do **(Idah, Duiker High School).**

Lack of interest in science, mathematics and technology related activities was cited by some of the participants as a likely factor why some female pupils were not members of JETS Club. Some of the participants expressed their views as follows:

> I think most girls lack interest in some activities like JETS because they think it's a waste of time. They would rather go home and meet with their friends, talk about certain things rather than stay in school and participate in JETS activities **(Felistus, Eland High School)**.

> They are not interested in science and mathematics. They are rather interested in things like Choir, Drama and Anti-AIDS. Most of the things they do there are opposite to what we do here in JETS Club. They think our clubs is boring **(Grace, Buffalo High School).**

The tendency by female pupils to depend on others to do difficult tasks for them was also given by some participants as a factor which made some of the female pupils decide not to join JETS Club. They claimed that most female pupils had an internal personality of depending on other people, especially males to do difficult things for them. Therefore, they would not take up a challenge to do something perceived to be difficult like JETS tasks. They normally waited for someone else to do it or help them. One participant put it this way:

> I also think girls do not join JETS Club because they are too dependent. They will always depend on a man to do everything. Even in a home where there is a mother and a father, most of the time the father does everything while the mother is always cooking and just doing house chores **(Albertina, Eland High School).**

The thinking possessed by some female pupils that they were not so intelligent to be in JETS Club, was cited as a possible factor why some female pupils kept way from JETS Club. Participants submitted that they were of the view that some female pupils did not join JETS Club because it was perceived to be a club for high achievers. Two participants said:

> Here in school, most female pupils think JETS Club members are intelligent. In grade 8 if you join JETS Club most of them will say 'no' obviously she is intelligent and everything like that. So those who think they are not intelligent, they keep away **(Elinah, Buffalo Secondary School).**

> Boys having that mentality of saying we are very much intelligent so they join clubs like JETS but the girls having that mentality of saying no us we are not at the same level with boys in terms of mental ability. They will not join JETS Club **(Ellen, Duiker High School).**

Participants were of the view that that some female pupils decided not to join JETS because they felt that things learnt in JETS Club were the same as those covered during time-tabled lessons. Some participants expressed their views as follows:

> Some other girls say that "why should I join JETS, what they learn in JETS, I am still going to learn about it in class. So there is no point in me joining JETS because we will still learn the same things at the end of everything" **(Naomi, Buffalo Secondary school).**
>
> This is maybe most of the topics discussed in JETS are also discussed in class. So they think that most of the topics we discuss in JETS, they will also discuss them in the classrooms **(Harriet, Antelope High School).**

Lack of knowledge about activities done in JETS Club was also advanced by some participants as a possible reason for some female pupils not joining JETS. They indicated that a number of female pupils did not have adequate information about what JETS was all about and made uninformed decision not to join JETS. Regarding this view, some participants said:

> One thing I have noticed is that girls judge JETS before they even enter it, before they even find out what we do in the club, they judge the book by its cover. They think it is a club that is boring and that is for *nerds* (book worms, who are into science and they are a bit crazy, they are just in their own world). So some judge the club before they enter the club **(Doreen, Duiker High School).**
>
> On my part, with the experience that I have had with certain girls when I have been passing announcements in classes, they will say "ahhh, JETS what do you do in JETS, all you girls think about are projects. You come up with this you come up with that". So I think they lack knowledge of what JETS is all about **(Felistus, Eland High School).**

Linkage of JETS Club to jobs, regarded as dirty by some people, was also given by some participants as a possible reason for some female pupils not joining JETS Club. Participants said that some female pupils associated JETS Club with careers such as engineering and that of a technician. Normally because of the nature of these jobs, engineers, mechanics and technicians are in most cases dressed in work suits, with spots of oil and grease including their hands. Therefore, they thought that participation in JETS activities would also make them look the way engineers and technicians appeared, which they did not like. One put it this way:

> Those who are technicians and engineers, are considered as people who are in dirty jobs. So you know how girls are. They are kind of clean. So, they think like, "me being in JETS Club, I am going to be that kind of person. I am going to stop bathing". So I think that is what contributes to them not being in JETS **(Ireen, Antelope High School).**

Another issue which came through was the perception that JETS was boring. In this regard, some participants claimed that some female pupils avoided joining JETS Club because they considered it as unexciting compared to other extra-curricular clubs. One participant said:

> The other thing that discourages them I think, is the thing of saying that the club is boring. We have different clubs there are those clubs which involve dancing and, performing a lot. But JETS Club does not involve these **(Lucia, Antelope High School).**

Some family members not allowing female pupils to remain in the school to engage in JETS activities after time-tabled lessons, was reported as one factor which made some female pupils not to join JETS Club. For example, some participants said that they were of the view that some female pupils were not able to join JETS Club perhaps because they were not allowed to stay at school after lessons by some family members. One participant put it this way:

> I think also the family contributes to why girls do not join JETS Club. You find that a girl is living with someone who is a step-mother or something like that and they do not really allow them to stay in school after school hours to participate in JETS. Immediately they knock off, they go home **(Doreen, Duiker High School).**

The tendency by female pupils not to join JETS Club was also attributed to the perception by society that it did not think female pupils were suitable to enter certain professions associated with JETS Club activities. Participants were of the view that society in which female pupils grew up made the girls believe that it was not appropriate for them to enter science-based careers, and therefore considered participation in JETS Club of no use. Some participants said:

> I think it is the type of society we are being brought up in. In societies, girls are thought that their place is in the kitchen. They should not do anything else apart from that. They cannot be engineers. So I think it is the kind of way in which people are being brought up because in as much as people do advocate for equality between boys and girls, it is a fact that society and girls still believe that the only place where they are productive is in the kitchen. So this notion has made girls shun JETS Club **(Daisy, Buffalo Secondary School).**

> I think the other reason some girls don't join JETS is the cultural background where they come from. For example, if I come from a home where I am taught that things like literature and the like are for girls while mathematics and sciences are for boys, I will tend to grow up with a mentality like ok, JETS Club is not my type. So I think tradition has also contributed **(Celina, Buffalo Secondary School).**

Opposition from some family members was given by some participants as a possible reason for some female pupils deciding not to join JETS Club. Participants said that they were of the view that some female pupils avoided joining JETS Club because of their brothers who did not want them to be members of the club:

> Some of them do not choose to join JETS club because their brothers tell them 'no' you are just a girl. Then others, it is their fathers who say you must be a lawyer like me. So JETS is useless for you **(Mary, Buffalo Secondary School).**

Discouragement from fellow pupils was cited as one of the possible causes of some females not joining JETS Club. Participants said that they were of the opinion that the negative influence not to join JETS came from fellow female pupils. One participant said:

> Some girls would be like don't join JETS Club, let us go and join drama, we will be together and stuff like that. So they follow as well and join a club where their friends are or a club friends also want to join **(Florence).**

Some participants submitted that they were of the view that some female pupils did not join JETS Club because they were intimidated by male pupils. One participant said:

> I also think that girls in some way are intimidated by boys because mostly in co-education, it is believed that boys are good in mathematics and sciences. They just leave it for guys because of what they experience **(Beatrice, Buffalo Secondary School).**

Discouragement from pupils in the JETS Club was also thought to be one reason why some female pupils did not join JETS. One participant put it this way:

> Some girls shun JETS maybe because of the reactions that they are getting from their friends in JETS Club. For example, as we said, there were times that we did not feel very welcome in the club. so someone with that mind of when I go into that club, I think someone should welcome me, the moment they do not feel welcome, they will go out there and say I cannot be in that club because it seems no one wants to interact with me **(Francisca, Duiker High School).**

Some participants attributed the situation why not many female pupils were members of JETS Club to non-provision of information by the school about what JETS Club was all about. Concerning this aspect, one participant said:

> There is not much knowledge about JETS in schools in that the school does not provide much information. I think there should be some sensitisation on what JETS is all about by schools **(Grenda, Eland High School).**

Negative reactions by some teachers to some female pupils who showed interest in joining JETS Club was cited as a possible factor contributing to some female pupils avoiding to join JETS Club. Regarding this issue, one participant said:

> The way some patrons relate to some pupils also matters because there are some pupils who want to join JETS very much but because of the negative response they get from patrons, it will discourage them. This is because some patrons ask pupils showing interest discouraging questions such as "Do you think you can manage to be in JETS?

> JETS Club is not for people like you" **(Francisca, Duiker High School).**

Fear of being in JETS Club was also cited by some of the female pupils who participated in this study as one factor which might have made some of the female pupils not to join JETS Club. One participant expressed this view point as follows:

> I think that some of the girls fear being in JETS Club **(Ireen, Antelope High School**).

CHAPTER FIVE

DISCUSSION OF FINDINGS

5.1 Discussion of Findings related to Influences on Female Pupils' Decision to join JETS Club

The discussion of findings concerning influences on female pupils' decision to join JETS Club is presented according to the following themes: challenging existing gender norms; aspirations; interest in science and science related activities; and self-concept of intellectual ability.

5.1.1 Challenging Existing Gender Norms

Some female pupils decided to join JETS Club so that they could challenge gender norms, that is, to show that they were intellectually equal or superior to male pupils. They wanted to do what boys were doing in JETS Club and to do better than the boys did. This means that they held the view that they were mentally equal or better than the boys. This is in agreement with a study by Modi, Schoenburg and Salmond (2012), which found that a number of female pupils regarded themselves able to do anything male pupils could do in science, technology, engineering and mathematics. However, it is contrary to other studies e.g. Mwase *et al.,* (1999) which found that female pupils did not think of being as capable as boys. This was unexpected in the sense that it is generally believed (though perhaps incorrectly so), that boys are intellectually better than girls (FEMSA, Dissemination Report No. 6; Mwase *et al.,* 1999). This belief has also been reported among teachers (Mbano, 2001; Ndunda, 1999) and society in general (Davison, 1993). The position held by some of the female pupils who participated in the current study that they were intellectually equal to some boys was in line with the view held by Kelly (1994), who argues that there is no basis to accept that female pupils were of low intellectual ability. He believes that girls have the same mental ability as boys. Similar sentiments have also been expressed by two Zambian scholars, Shinondo (1998) and Mwase (1998), that there is no difference in intellectual ability between boys and girls. Indeed, families, schools , pupils and society at large in Zambia considered females as being different from males in terms of sex, intelligence, roles they are expected to perform in society, subjects they are expected to study at school (Kelly *et al.,* 1999; Mwase *et al.,* 1999) and extra –curricular clubs they are supposed to join while in school. Although it may be correct that females and males are different in terms of sex due to some different biological make up, the rest of the differences claimed such as intellectual capacity may not be correct.

Some parents, teachers and pupils in Zambia, wrongly believed that sciences, mathematics and technology were male-typed, meaning that they did not expect female pupils to study them (Mwase *et al.,* 1999). The perception of sciences as being domains for boys has also been reported in Southern African countries, where girls are streamed into Arts subjects while boys are streamed into the sciences (Meena, 1992). Similar beliefs have been reported in Nigeria (Erinosho, 2001a), Cameroon, Ghana, Tanzania, Uganda (FEMSA, Dissemination Report No. 5, n.d) as well as in Malawi (Mbano, 2001; Davison, 1993). In the same way, certain extra-curricular clubs in school were perceived to be for boys while others were for girls. This means that there was stereotyping of membership of clubs in Zambian schools. Since JETS Club was a science, mathematics and technology-based club, and involved activities which required a lot of thinking, it was assumed wrongly to be a club for boys by both female and male pupils, as well as some teachers (especially in co-education schools) and some family members.

Although some of the participants in the present study considered themselves different from boys in terms of sex, they still regarded themselves to be equal or better than boys in terms of cognitive ability. Thus, these girls chose to disregard societal gender role expectations by joining JETS Club. They wanted to demonstrate that there was no gender difference in terms of mental ability between boys and girls, thus belonging to JETS Club which was considered as a boys' club by both males and females pupils, family members and some teachers. Furthermore, various studies support the notion that male pupils are not intellectually superior to female pupils in relation to science. For example, a study by Erickson (1984) found that the achievement of girls was not poor compared to that of boys. Other researchers (e.g. Kahle & Meece, 1994; Whyte, 1986; Abell & Lederman, 2007) have established that there are no inborn differences between female and male pupils' in their mental ability. In Thailand, where every pupil is expected to take science at secondary school level, Klainin and Fenshman (1987) found that female pupils did better than male pupils in chemistry, while in physics, female pupils' achievement was as good as or better than male pupils. Female pupils have also been reported to have performed better than male pupils in technological literacy (Duyilemi & Oluwatelure, 2012). Furthermore, a review of literature from 1970 to 1991 showed that the attainment of female pupils in science in the primary schools was similar to that of male pupils (Weinburgh, 1995). A similar finding has also been reported by Dimitriadi (2013). Research attributes the low attainment of female pupils in science subjects to social factors rather than to mental abilities (Meece & Jones, 1996). This is particularly so at secondary school level where the influence of social factors become pronounced. Yoyer and Voyer (2014) assert that better performance of female pupils in comparison to male pupils in compulsory schooling phase is an issue which has not been widely published.

Several studies have found that girls normally have less confidence in science, mathematics and technology than boys (e.g. Eccles,1994; Gatta & Trigg, 2001; Mwase *et al.,* 1999; FEMSA Dissemination Reports Nos 10 and13; Lenga, 2001) and yet confidence is important in promoting participation of female pupils in SMT-related activities (Erinosho, 2001c). This study has, however, established that this group of female pupils is different in that it had as much confidence in engaging in science and technology related activities as some male pupils had. These females believe that they have the ability to undertake activities in JETS which have been regarded as boys' activities because boys usually consider themselves to be better than girls mentally. Thus, these female pupils acted contrary to a general expectation of society in Zambia (Kelly, Msango & Subulwa, 1999). They revealed that they were somewhat unique from the rest of other female pupils. The implication of this is that, if more female pupils have to join JETS Club, there is need to enhance their confidence in science, mathematics and technology. This could be done through the use of role models and verbal persuasion (Bandura, 1986).

One might wonder what gave these female pupils the courage to challenge the stereotypical thinking that JETS Club was for boys only in Zambian schools. From the responses they gave, it can be deduced that these female pupils had traits such as bravery, competitiveness, assertiveness, determination and high self-esteem. It is these attributes which made them challenge the general thinking. There are several sources of these qualities. A good number of female pupils who participated in the present study were first born children in their families. Normally, first born children are associated with these kinds of characteristics (Surfnet Parents, 2011). A number of participants in the current study had a family member in science-based or science-related career and had the cultural capital. Thus some female pupils may also have acquired the self-confidence from family members through encouragement or through having a role model in the family. Family members have been reported to be a major source of self-confidence for female pupils to take up challenging tasks (Erinosho, 2001c; Nassor, 2001b). Female pupils also develop self-confidence to engage in tasks perceived to be for boys through observing others do it or have heard that some have done it, as well as through social persuasion (Bandura, 1986); others might have performed very well in class in SMT subjects and perhaps scored higher marks than boys, and so this encouraged them to think that they could undertake tasks in JETS Club (Bandura, 1986, 1997) successfully.

Thus, the thinking that female pupils were mentally equal or superior to boys was also reinforced by some family members. They uttered statements which encouraged female pupils to stop thinking that they were females and that SMT-related subjects or activities were domains for male pupils only. Some parents also expressed support to female pupils' decision to join JETS Club. There are explanations as to why parents encouraged female pupils to join JETS Club. One of the reasons is that they were entering an area perceived to be for males in the family, in which none of the female family members had entered before, a move which was regarded as something worth supporting. Another explanation for parents' support of their daughters' decision to join JETS was that, they believed that their daughters would act as role models for their sons. This was something new and surprising in the Zambian context, for a female pupil to act as role model for boys in an area traditionally dominated by males. Again this demonstrates that these girls were extraordinary from the rest of female pupils in Zambia. The implication of this is that if female pupils joined JETS Club, they would encourage both their sisters and brothers to join this club too. That is, they will be role models. As Dimitriadi (2013) points out, role models are essential in raising the aspirations of youths.

The drive to join JETS Club by some female participants for purposes of improving their performance was strengthened by male classmates who performed well in class. These male classmates reinforced female pupils' wish to join JETS Club because of the need to perform just as well as the boys were doing during formal lessons. They regarded participation in JETS Club activities as a means through which they could perform as well as these boys in their class. Furthermore, male pupils who were already in JETS Club reinforced female pupils' decision to join JETS Club through their good performance in class. Therefore, female pupils believed that if they joined JETS Club, they would perform in class as well as boys in JETS Club were performing, which was one aspect of Bandura's Social Cognitive Theory, that states that the success of others makes one think that she or he can do it too (Bandura, 1986).

Challenging existing gender norms-oriented-motivational talks by teachers also reinforced female pupils' stance to join JETS Club. This means that some female pupils' self-confidence to join JETS Club was raised when they heard male teachers explaining that JETS Club was not only for boys but girls too. The influence of motivational talks by teachers is in agreement with what Bandura (1986) referred to as "verbal or social persuasion". Verbal persuasion suggests that one can make a decision such as to join a club, if one gets encouragement from other people such as teachers, who are considered to be important (Bandura, 1986). Indeed, in recent years there has been a lot of sensitization and encouragement in Zambia, to teachers to promote participation of female pupils in science and technology activities. This is through programmes such as Action to Improve English, Mathematics and Science (AIEMS) which ended in 2001, Female Education in Mathematics and Science (FEMSA) Project, which also came to an end in 2001, and also Forum for African Women Educationalists of Zambia (FAWEZA). This sensitisation may have led to some science teachers putting into practice what they had learnt during meetings or workshops organised by the programmes and organisations mentioned above.

In some cases, teachers encouraged female pupils to join extra-curricular clubs such as JETS because they believed that female pupils had the capability to do so as boys do. It may also mean that some teachers encouraged female pupils to join JETS Club because they thought that they would acquire knowledge, skills and attitudes which would support their learning of science, mathematics and technology in class. This seems to suggest that in science classrooms, opportunities for acquisition of scientific skills and attitudes were limited or in some cases non-existent at all. O' Connor (2001) described the teaching and learning of science in countries which participated in Phase II of FEMSA Project (of which Zambia was part) as consisting mainly of teacher exposition, copying notes as well as asking questions and responding to teachers' questions. The implication of this is that pupils were not actively involved in the learning process, a situation which is not conducive for learning for female pupils (Cole & Griffin, 1987).

The desire for gender equality influencing female pupils' decision to join JETS Club authenticated other studies (e.g., Baker & Leary, 1995; Eccles & Wigfield, 2002; Malambo & Ntalasha, 1999; Wan, 2006), which found that gender equality influenced decisions or choices. Furthermore, the beliefs held by some of the respondents in the current study were similar to those of lecturer respondents in a study by Matope and Makotose (2007) in Zimbabwe, who were of the view that female students chose to pursue engineering because they were intellectually capable as male students to understand engineering tasks.

The viewpoint held by this group of female pupils corroborates with that of the liberal feminists, who hold the view that both female and male pupils are the same intellectually (Sinnes, 2005).

5.1.2. Aspirations

Some female pupils decided to join JETS Club because of the aspirations they had. Participants considered participation in JETS activities as useful to achieving their aspirations. One of the aspirations some of the participants had for wanting to join JETS Club was the desire to pursue a science or technology-based career, such as medicine and engineering after completing high school or senior secondary education. The science and technology-based careers, participants intended to pursue in Zambia, were traditionally associated with males in Zambia and other countries (Harding & Apea, 1990) as well as people with high intellectual ability. Normally, students admitted into these programmes of study in institutions of higher learning in Zambia, were those who scored high marks in science-related subjects in the school certificate examination, and in first year science-based university courses. Thus, female pupils' decision to join JETS Club was due to the fact that they viewed participation in this club to be a means to help them score high marks in mathematics and sciences, thereby achieving their aspirations of entering these non-traditional high status careers such as medicine. This is in line with the Modern Expectancy-value Theory, which states that usefulness has an influence on choice people make (Eccles & Wigfield, 2002).

The desire to pursue science-based careers as a reason for joining JETS was also confirmed by teachers associated with JETS Club, who indicated that female pupils considered JETS as a stepping stone into science and technology-based careers. This finding is interesting in that it reveals the difference between these female pupils and the rest of their colleagues because of their desire for non-traditional careers; one would expect female pupils to aspire for traditional social related careers such as nursing and secretarial work. What has been observed in Zambia is that girls generally aspire for traditionally-social related jobs. However, it would be more surprising if this group of female pupils opted for nursing and secretarial work, since they were interested in science, and were very ambitious to join non-traditional careers for girls. The consequence of their desire to pursue careers which society has stereotyped as male careers is that they would be considered as having gone against societal expectations. Hence they are likely to encounter some challenges in society, which expects females to do certain roles. For example, people will challenge them in their places of work or discriminate them in one way or another in things such as promotion or opportunities for continuing profession development. Other challenges females who enter what is wrongly perceived as male careers have been cited by researchers (see e.g. Neal & Hammer, 2006; Harding & Apea, 1990; Wynarczyk & Renner, 2006; Buse, Bilimoria & Perelli, 2013).

The desire to join JETS Club because it would help female pupils to attain their aspiration of pursuing science based careers was reinforced by some members of their families. This reinforcement seemed to have come from families which had cultural capital (i.e. families whose members had the knowledge, experience, skills, beliefs etc.) required by female pupils to succeed in certain careers, and were able to pass on this information to them (Bourdieu & Passeron, 1990). Some of the family members encouraged participants to join JETS, because they were of the view that participation in JETS activities would equip them with knowledge, skills and attitudes required to enter science-based training programmes, such as medicine and engineering, as well as succeed in their training in these fields. However, it has been observed that the influence of family members, in particular, parents on children in relation to choice of science-related activities or subjects tend to drop as female pupils start to interact increasingly with teachers, other pupils and role models (Johnston & Spelepeng, 2001). This change in terms of sources of influence, explains why some of the female pupils indicated that they were motivated to join JETS Club by their peers, teachers or role models.

The desire to secure scholarships in order to pursue training in their areas of interest at universities outside Zambia influenced some participants to join JETS Club. This means that participants had the belief, that through participation in JETS activities, they would get the sponsorship they wanted. The desire to secure a scholarship through involvement in JETS by some female pupils was reinforced by past JETS Club members, who they knew to have secured scholarships through participation in JETS activities, to study abroad. A number of factors are responsible for respondents' desire for scholarships. One of them is the low income levels in the family. Poverty levels are generally high in Zambia, thus, an average parent is not able to sponsor a child, especially females, who may want to pursue science-related courses offered outside the country. There was also a belief among some parents in Zambia that educating a girl was less important or beneficial compared to educating boys, because the girl would get married, and therefore would not be in a position to support them, but instead the family of the husband would benefit much more (Kelly, Msango & Subulwa, 1999). This belief has also been reported in Cameroon, Ghana, Tanzania and Uganda (FEMSA, Dissemination Reports Nos. 5 and 6, n.d.). Therefore, with this kind of belief, when poor parents are faced with a decision as to who they should spend their money on, they normally opted to support a boy (Davison, 1993; Kelly *et al.,* 1999; O' Connor, 2001). This belief is incorrect to some extent, in that daughters, even when they are married, continue to provide support to their parents. Generally, they are more supportive to their parents than male children. Therefore it is morally wrong to deny them financial support in education. The thinking by society that science and technology-based careers were more appropriate for males than females, also contributed to the challenge of females getting support from families to pursue further studies in science and technology-based careers outside Zambia. Consequently, unless female pupils secured a scholarship on their own, they would not pursue a science or technology-based career outside the country. Another reason for aspiring to get a scholarship is that, being awarded a scholarship to study outside the country, especially as a female, was prestigious in that other people would talk about you, and admire you, as the case was with Martha mentioned by one of the participants in the previous chapter.

Another type of aspiration reported by participants and supported by teachers, was the desire to receive awards. One reason why some participants wanted to receive awards was that getting a reward was exciting, because it brought pride to themselves, parents as well as other members of the family. To be given an award at school for good performance in science or technology-related area was something very memorable in life, because it proved that female pupils also performed well in SMT subjects (Mwase *et al.,* 1999). It attracted praises from family members and admiration from school-mates. It can be argued that, it was for this reason that some female pupils had a strong desire to win prizes while at school. Since some of the winners of awards were participants in JETS Club, they were of the view that by joining JETS Club and participating in its activities, they would also be awarded prizes.

Thus, prize winners who were in JETS Club acted as role models to some of the girls and inspired them to join JETS. This finding corroborates with the vicarious experiences component of Bandura's Self-efficacy Theory, which advances the view that a positive or a negative decision is made by a person through watching and assessing the outcomes that accrue to another person engaged in a particular activity. Thus, as pupils observe others get rewarded for what they do, they also got influenced to join (Bandura, 1986). This finding further supports a study undertaken by Agholor and Okebukola (1998) in Nigeria, which found that female pupils joined JETS Club because of the awards given to those in the club who performed well in JETS competitions.

One more kind of aspiration which came through from female pupils, which was also supported by some teachers interviewed, was the desire to achieve success in school. The desire of most female and male pupils in school is to pass well in most subjects. Female pupils desire to do well in science and mathematics because it brings pride and joy to oneself and to the family. It also opens doors for further education in SMT-related courses which some of the participants aspire to achieve. However, examination results from the Examinations Council of Zambia (ECZ) revealed that science and technology-related subjects had often proved difficult for female pupils in general, to pass with good grades, to enable them progress in science and technology (Kelly, 1999; Mwase *et al.,* 1999). For example, the quota for female students in the bachelor of science with education programme at the University of Zambia could not be filled to the required number by female applicants for a number of years, because most female pupils who applied did not meet the required grade in some science subjects, including mathematics. Studies done elsewhere in Africa had also revealed a similar pattern of poor performance among female pupils in SMT subjects (see e.g. Erinosho, 2001a; Nassor, 2001; FEMSA, Dissemination Report No. 5). As a result of this poor performance and sentiments expressed by other pupils regarding the perceived difficult nature of science subjects, some female pupils decided to join JETS Club so that they could supplement what they learnt during formal lessons in order to avoid failing in these subjects. In other words, they had a desire to acquire more knowledge and skills including thinking.

One way some participants thought they would achieve the above mentioned aspiration was through attending JETS Club lessons. Some of the lessons during JETS Club meetings were conducted by fellow pupils. This arrangement provided a good opportunity for pupils to learn from each other and was beneficial to both the pupil teaching and the pupils being taught in terms of knowledge acquisition (Association for Science Education, 2008; MoE, 1996). Those that were taught were able to ask questions from those who taught them without any fear. Those who taught, learnt new things through the preparations they did for their teaching since they had to read widely for these lessons. Pupil to pupil learning has also been supported as being a good practice by other scholars (Savage, 1999; Naidoo & Savage, 1999). Furthermore, in Zambian schools, not all that is prescribed in the syllabus could be covered by teachers during scheduled lessons (Haambokoma, 2007), and yet examiners assumed that all aspects of the syllabus were covered and set questions on the entire syllabus. Thus, female pupils thought of joining JETS Club so that they could learn those aspects not taught in class.

One more aspect which made good performance in school in science and mathematics important for female pupils, was that in recent years, the status of science subjects including mathematics had been raised in Zambia. For example, in order to pursue training in what was perceived as traditionally female courses such as primary school teaching or nursing, one of the entry requirements was 'O' level pass in a science subject and in mathematics. This applied to both females and males. Therefore, the need to do well in science and mathematics for female pupils became necessary if they had to enter a science-based training programme after school. In view of this, some participants were of the view that participation in JETS Club activities would enable them to acquire more knowledge and skills that could make them achieve success in mathematics and science. Desire for more knowledge as a motive for joining JETS Club is consistent with the outcome of a study by Fredricks, Alfeld-Liro, Hruda, Eccles, Patrick & Ryan (2002), which found that the desire for more knowledge so as to perform better, influenced one's decision to participate in an activity.

In some families of participants, certain members strengthened female pupils' personal desire to succeed in school, particularly in SMT subjects, contrary to reports by Mulemwa (1999); Mwase *et al.,* (1999); O'Connor (2001) and FEMSA (n.d.) that families discouraged female pupils from studying SMT subjects because they were believed to be difficult and also considered them to be domains for boys. For example, fathers and mothers of some participants encouraged their daughters to join JETS club because according to them, they were of the view that it would help their daughters to succeed in school subjects such as chemistry and physics which were normally male-typed subjects (Easlea, 1986) ,and in which normally female pupils performed badly.

Another unanticipated outcome was that even some parents who were not in science-based fields, encouraged their daughters to join JETS Club. This was strange because normally parents who were not in the science fields would not encourage their daughter to pursue interests in SMT areas because society in Zambia generally thinks that SMT subjects are not for female pupils. One possible explanation for this supportive attitude could be that they believed that participation in JETS activities would improve their daughters' performance in science subjects and achieve their career aspirations. This thinking has been supported by some researchers (e.g. Agholor, 1994; Clewell & Darke, 2000), who found that some pupils who participated in science-based extra-curricular activities improved in their academic performance. Some parents were also of the view that participation in JETS activities would equip their daughters with skills and attitudes which they would still use in life in general. Furthermore, currently society has challenges which require scientific and technological knowhow in order to deal with them. Therefore, without scientific knowledge, skills and values, these parents were of the view that their daughters would not live a successful life in a modern society full of scientific applications. This thinking is in line with the argument by Bourdieu and Passeron (1990) that parents make available to their children 'cultural capital' by providing them with information needed to succeed.

Even when some female pupils had finally joined JETS Club, they continued to get support from their parents for them to continue being members of the Club. Interestingly, the encouragement and support they reported came from their mothers. This was revealing because normally in the Zambian situation, a mother would not support a daughter thought to be defying gender role expectations by joining science, mathematics and technology-related club. This is so because girls are expected by society to get married and bear children. Therefore, they are culturally expected to learn to be good wives and mothers. Responsibilities of a wife and a mother at home would suffer at the expense of office work, which may continuously result in a conflict with husband. Mothers do not like to hear such a situation. It is generally perceived that participation in science-related extra-curricular clubs would not make them good wives and mothers. Similar sentiments have been expressed by Ekine and Abay (n.d.). Within the Zambian society, there is an incorrect belief that if a female pupil studied science and entered a science-based career, she would not marry as men would be scared of her, and mothers did not like this. If however she married, she might not be a good wife and mother because of the high demands of masculine-typed jobs such as the science based ones (Gerdes, 1995; Beseche & Reilly, 2006).

The support from mothers can be explained in different ways. One explanation is that the mothers of these girls were of the view that involvement in JETS Club would help their daughters succeed in classroom-based activities, particularly in science subjects which were perceived by parents, teachers and female pupils themselves to be difficult for girls (Kelly *et al.,* 1999). They were also happy that their daughters were courageous enough to join a club which was mainly perceived to be for intelligent pupils. It could also have been that during their time at secondary school, these mothers did not join JETS Club because of discouragements from their mothers at that time. Therefore, this time around, they wanted to change the situation for their daughters because the world was becoming more scientifically and technologically-oriented. Another explanation is that these mothers might have attended gender sensitisation workshops, at which they were encouraged to support their daughters to go into science and technology fields. Supportive attitudes of some parents for girls' participation in SMT subjects as a result of the FEMSA sensitisation activities has been reported in some countries by O'Connor (2001). Female pupils received more encouragement and support from mothers to join JETS Club, because their mothers' expectation of them to engage in JETS activities successfully was higher than that of fathers. In Zambia, fathers generally have lower expectations of their daughters to engage in scientific and technological activities.

Wanting to join JETS Club by some female pupils so as to achieve success in school was also influenced and reinforced by some of their male friends who were performing very well in biology, chemistry, physics as well as in mathematics. In this regard, the friends who were doing well, advised participants that if they joined JETS, it would help them to do well in school, particularly in sciences and mathematics. This support was surprising because it was contrary to the widespread belief in Zambia that boys had low expectations of female pupils to perform well in SMT subjects (Kelly *et al.,* 1999), and that they would not encourage them to do well in sciences. Furthermore, in the Zambian society in general, males would always like to be above females in aspects such as education and financial status. The way they can be above females in terms of education is not to share information with females which would make them succeed in education too.

There are several reasons why high achieving friends responded this way to female pupils under study. One explanation is that they felt happy to learn that their good performance in class was being recognised by other pupils particularly females. They were, therefore, very willing to share what was behind their success with them. Another reason is that they had a general desire to see girls succeed in science and mathematics since there were not many such girls interested in these subjects. The boys were also humbled when they were approached by female pupils, who wanted information on how they would also achieve success in male-typed subjects. Female pupils regarded their male friends as significant others and therefore took their advice seriously by joining JETS. This finding corroborates with other studies (EndI, n.d.; Bourdieu & Passeron, 1990; Dlamini, Ngwenya & Dlamini, 2004; Matope & Makotose, 2007; Haambokoma, 2009; Henriksen, Angell, Lavonen & Ines, 2004; Welty & Puck, 2001; Wan, 2006) which found that friends had significant influences on decisions made by other pupils in relation to taking a subject, joining an extra-curricular activity or career choice.

The personal drive to join JETS Club by female pupils who wanted to achieve success in school was also strengthened by some female JETS Club members, who told them that participation in JETS Club activities would help them to improve their achievement in class. It also came to light that some teachers also motivated female pupils to join JETS by informing them that they would achieve success in class in mathematics and science. In this regard, both club members and some teachers used persuasive talks to get some female pupils to join JETS Club. This encouragement given by both club members and teachers to female pupils to join JETS Club, also accords with Bandura's idea of verbal persuasion, which suggests that oral encouragement and support one receives from people considered to be important influenced one's decision to take up or do something (Bandura, 1986). It raises someone's self-esteem to make a decision.

There are several explanations why some JETS Club members as well as some teachers thought that girls would succeed in school, particularly in mathematics and sciences if they joined and participated in JETS activities. One reason is that since JETS activities such as quiz and projects involve extra reading and/or research, female pupils would acquire more knowledge and skills which they would also use during time-tabled mathematics and science lessons. Another explanation is that they would also have an opportunity to learn from and to ask other club members (who may be knowledgeable) questions during club meetings in their own school and when they visited other schools. Regarding asking questions by pupils for clarification, Maimbolwa-Sinyangwe and Chilangwa (1995) found that pupils were more free to ask their fellow pupils questions than asking teachers questions. Some SMT teachers tended to be harsh and did not encourage questions from pupils, in particular females, whom they considered to be incapable of learning these subjects (Mwase *et al.,* 1999; Kelly, Msango and Subulwa, 1999; FEMSA Dissemination Report No. 13). Female pupils also do not like to attract negative comments from male pupils by asking a teacher questions. Female pupils are also given an opportunity to teach others on a given topic which requires preparation. Thus, during the process of preparing to teach and during teaching other members, such pupils would also learn. The pupil-to-pupil learning strategy, where pupils are given an opportunity to share information with each other has been reported to be an effective means of promoting learning (Mulemwa, 2001). It is claimed by some pupils that explaining something to another person aids understanding and remembering.

Furthermore, it was established that some participants decided to join JETS Club because of the aspiration they had to come up with something new. This meant that they considered JETS Club to be an appropriate opportunity where they could come up with an invention. Some of the female pupils were motivated to think in this direction because not as many females as males had come up with something new and useful to society in the science worldwide. This thinking is in line with that of radical feminists who hold the view that if females enter the science and technology domain, they would come up with something which men have not thought about, that could be useful to society, in particular, women. Additionally, there were a lot of challenges in life, particularly in a developing country like Zambia, which required both males and females to think outside the box in order to come up with devices that could overcome some of the challenges. Participants regarded JETS Club as an appropriate avenue to exercise one's inventiveness and creativity because they were allowed to play around with any idea, so long as that idea was a project. Aspiring to be an original thinker by female pupils is an unexpected finding in that the majority of female pupils in Zambia avoid tasks related to coming up with something new which involves imaginative thinking. This finding shows the uniqueness of some of the female pupils who opted to join JETS Club. In some countries, innovation is highly prized and encouraged because it is the basis for development. Thus, the implication of this is that if Zambian society would like to enhance creativity in Zambia, there is need to encourage more females and provide more opportunities for them to participate in science and technology related activities at school which encourage them to experiment with different ideas that they may have. Some of these ideas may result into something very useful.

Aspirations influencing female pupils' decision to join JETS Club support previous studies (e.g. Smart & Rahman, 2009; Walkington, 1998; Henriksen, Angell, Lavonen & Ines, n.d.;

Erinosho, 2001; Chimwayange & Davies, 2004; Malambo & Ntalasha, 1999; Weiss & Ferrer-CaJa, 2000; Wan, 2006), which link choice of science and technology activities or subjects to one's aspirations, such as future career plans. Furthermore, the finding that future aspirations influenced female pupils to join JETS Club is in line with the Modern Expectancy–value Theory presented in chapter one, which supposes that perceived usefulness or helpfulness of a task or undertaking in future, influences a person's choice or decision to engage in that particular task or activity (Eccles *et al.,* 1983; Eccles & Wigfield, 2002; Wigfield, 1994).

5.1.3 Interest in science and science related activities

Interest in science made some female pupils to join JETS Club. Analysis of participants' statements showed that they were interested mainly in the life sciences aspects dealing with plants and animals . This observation is consistent with prior research (e.g. Entwisle & Duckworth, 1977;Tamir, 1975; Solomon, 1997) which found that female pupils preferred biological sciences, such as botany and zoology, while male pupils preferred physical sciences. They felt that it was necessary to understand much more, the biotic than the physical part of the natural environment, since it was much more relevant to them because of what they were expected to do as females by society (i.e. look after people and other living things). Females are by and large human being oriented and are regarded to be more caring and better at communicating with other people (Dimitriadi, 2013). In relation to this aspect, a study by Jenkins and Pell (2006) found that girls considered helping people to be more important than boys. It has been observed that, of the total number of females in science-based fields, more were in biological science fields than they were in physical science fields (Mulemwa, 1999). For example, a study undertaken in Zambia by Haambokoma *et al.,* (2002) found that there were more females teaching biology than those teaching chemistry and physics in Zambian secondary schools. Preference for biology instead of chemistry or physics by female pupils at high school in Zambia has also been reported by Mwase *et al.,* (1999). A similar pattern has been reported in Cameroun, Ghana ,Tanzania and Uganda (FEMSA Dissemination Report Nos 5 and 13, n.d.). Nevertheless, although the majority of female pupils expressed interest in biological sciences, it is important to note that there were also a few female pupils who expressed interest in physical sciences.

The desire to join JETS Club by some female pupils arising from the interest they had for science was strengthened by some family members who also demonstrated liking for science by talking about it and showing interest in science. They regarded JETS Club as a good avenue for them to engage in science activities which they were interested in. Interest in science as having influenced female pupils to join JETS Club supports the intrinsic value or interest-enjoyment value component of the Expectancy-value Theory. According to this theory, interest is a key determinant of a decision or choice an individual makes (Eccles & Wigfield, 2002; Wigfield, 1994). The influence of interest on female pupils' decision to join JETS Club is also in agreement with those of other researchers (e.g. Chimwayange & Davies,2004; Erinosho, 2001; Haambokoma,2009; Wan, 2006; Vingilis-Jaremko & Vinglis, 2004; Matope & Makotose, 2007; Walkington, 1998; Kniveton, 2004; Smart & Rahman, 2009; Harris & Eccles, 2008) who found that interest played a role in influencing decisions or choices pupils and students took. The revelations that this group of girls was interested in science and science-related activities demonstrates that this group was different from the majority of female pupils in Zambian schools because, previous studies undertaken in Zambia had revealed that most females were not interested in science and science related activities (Haambokoma, 2000; Haambokoma *et al.,* 2002; Mwase *et al.,* 1999).

One aspect of science which influenced some female pupils to join JETS Club was the desire to carry out experimental activities and extended investigation, commonly known as projects. These participants may be described as pragmatists (i.e. practical persons who are keen to experiment). Research has shown that female pupils value project-based learning opportunities (see e.g., Liston, Peterson & Ragan, 2009). One reason for female pupils liking to conduct experiments was that, they were hoping that engaging in practical work would assist them to understand science as the saying goes "if I do, I understand". Experimental work is necessary in effective learning of science (Parkinson, 1994; Woolnough & Allsop, 1985), and learners find it interesting and useful in the sense that it facilitates learning of abstract scientific concepts. For example, Zesaguli (1999) revealed that pupils found practical work interesting and developed eagerness in practical projects in order to learn more content. Furthermore, various study findings support the value of experimental work. For instance, Burkham, Lee and Smerdon (1997) found that pupils who actively conducted their own experiments learned more than those who did not participate in experiments.

Apart from facilitating learning, engaging in science laboratory activities and hands on-learning improved female pupils' attainment of scientific knowledge (Burkham *et al.,* 1997; Houtz, 1995; Freedman, 1997, 2002). A further reason for wanting to engage in practical work was that experiments involved active participation of learners in cases where they took a learner-centred approach. Thus, they wanted to be active (i.e., learning through doing). It is commonly known that learning is an active process and, therefore, if pupils have to learn, they have to participate in the learning process (Driver, 1986). Another reason for expressing interest in experimental work has been that some female pupils have been hoping that through conducting experiments, they would discover something which has not been discovered before. It is generally believed that most discoveries in science come through conducting experiments. However, some scholars (e.g. Fabiano, 1998) have questioned the contribution of practical activities to enhancing pupils' achievement in scientific work. Furthermore, after reviewing literature on practical work, Hodson (1993) found that there was not much to show that practical work was useful in assisting pupils to learn scientific knowledge and values. Similarly, Watson, Prieto and Dillon (1995) found that the difference in the understanding of combustion, between a group which did a lot of practical work and the one which did few practical activities, was not much.

Expression of interest to engage in practical work in JETS Club by some participants also meant that there was inadequate or lack of practical work during formal science lessons in Zambian schools. Regarding this aspect, studies (e.g., Haambokoma *et al.,* 2002; Kapolyo, 1990) undertaken in connection with the teaching of science in Zambian schools, had revealed that opportunities for conducting experiments during time-tabled science lessons were not available during the majority of lessons. For example, Haambokoma *et al.,*

(2002) conducted a nationwide study which found that in biology, chemistry, physics and environmental science, the commonly used methods of teaching were teacher exposition, question and answer as well as demonstrations by teachers. As a result of this, pupils did not have chance to engage in experimental work and therefore remained passive, a situation not favourable to female pupils who normally like an engaging learning environment (Houtz, 1995; Burkam *et al.,* 1997; Freedman, 2002). In the same study, undertaken by Haambokoma *et al.,* (2002) pupils interviewed confirmed that during the lessons, they were expected to be quiet, listen to the teacher, observe and take down notes. Mulemwa (1999a) asserts that a situation where learners are passive during lessons is not good for female pupils. Therefore, they are disadvantaged in as far as learning of science is concerned in comparison to male pupils.

A didactic pattern of teaching science has also been reported in Uganda (see e.g Mulemwa, 1996b) and Tanzania (see e.g. Nassor, 2001). With reference to the situation in Kenya, Lenga (2001) revealed that the majority of teachers taught science theoretically and, therefore, making understanding of concepts difficult. In Cameroun and Ghana, science was reported to be taught in a non-practical way, and thereby contributing to poor participation by girls during lessons (FEMSA, Dissemination Report No. 10). With reference to SMT courses of twelve countries, which were part of the FEMSA Project, including Zambia, O'Connor (2001: 51) had the following to say in connection with the lack of practical activities during formal lessons:

> there is no room for curiosity and the questioning of accepted procedures; no room for creativity and new thinking, and wondering if something might be done better; no room for raising new questions and hypothesising; no room for testing our hypotheses, making adjustments in the light of our experimenting.In short no room for acquiring those skills, which would truly make science and technology the handmaidens of sustainable development.

This, therefore could mean that formal science lessons in general were not providing chance to pupils to acquire practical and thinking skills. Thus, as a result, some female pupils decided to join JETS for purposes of engaging in experimental work. The influence of practical work on female pupils' decision has also been reported by Wan (2006) in Hong

Kong, who found that practical work influenced positively girls' choice of science. This outcome was also in line with a study by Vingilis-Jaremko and Vinglis (2004) in Canada, which established that girls joined a science club because they liked engaging in experimental work. Liking of practical activities by female pupils has also been reported by FEMSA Coordinators in some African countries (Sinnes, 2004).

Some family members supported female pupils' decision to join JETS Club so as to fulfil their personal desire to engage in experimental activities. For example, one participant revealed that after expressing interest in conducting experiments to her uncle, the uncle directed her to join JETS Club while her sister mentioned to her that JETS was the most appropriate club in the school for her since she was interested in practical work. It could be that family members supported interest and participation in experimental activities because they were of the view that it was beneficial for them. Another aspect which came through was the impressive projects made by some members of the family, which strengthened female pupils' desire to join JETS Club. The girls developed a belief that if they joined JETS Club, they would also come up with projects of similar quality to those made by their family members. Therefore, some of the family members acted as role models for these female pupils to emulate.

Personal desire by some female pupils to join JETS Club because of the interest they had in conducting experiments was also supported by their friends. They did this through provision of information about opportunities for engaging in different types of practical activities in JETS Club, when participants expressed desire and interest in conducting experiments. What this means is that some of the friends of participants seemed to have been knowledgeable about JETS Club activities, hence their ability and willingness to provide information to them. Some people have argued that female pupils do not make correct decisions because they lack adequate information about science-based activities (see e.g. Dimitriadi, 2013). Therefore, the sharing of information was a good act. Some of the club members also contributed to strengthening female pupils' personal desire to join JETS Club through the inspiring projects they made in this Club. These exciting projects raised girls' self-esteem, as they began to think that they could also design projects similar to the ones made by pupils already in the club. Thus, the success of others made some female pupils think that they could also do it (Bandura, 1986).

5.1.4 Self-concept of intellectual ability

The belief by female pupils that they had the intellectual ability to successfully engage in JETS Club activities, emerged as another personal drive which influenced some female pupils decide to join JETS Club. In other words, they had a high expectancy for success (Eccles, *et al.,* 1983; Eccles & Wigfield, 2002). This motive was also supported by some teachers interviewed. This is extraordinary because female pupils had previously been reported to consider themselves not to have the mental capacity to engage in science, mathematics and technology activities (e.g. Mwase *et al.,* 1999). Indeed, some teachers, parents and members of the family had been reported also as not expecting female pupils to succeed in science, mathematics and technology subjects (FEMSA Dissemination Report No. 6 ; Mwase *et al.,* 1999; Kelly, Msango & Subulwa, 1999). However, some of the participants in the current study did not think that the perception held by others about their intellectual ability was correct. Thus, they decided to join a science, mathematics and technology-based club to prove to others that they could also engage in SMT activities. The implication of this is that if there is a wish to increase the number of female pupils participating in science-related activities, there is need to raise their self-esteem.

This outcome agrees with the findings of other studies (e.g., Cleaves, 2005; Barnes, McInerney & Marsh, 2005; Havard, 1996; Lyons, 2004; Smart & Rahman, 2009; Walkington, 1998; Liston, Peterson & Ragan, 2009; Henriksen, Angell, Lavonen & Ines, 2004; Matope & Makotose, 2007; Haambokoma, 2009; Actua, 2003; OLsZewski-Kubilius & Yasumoto, 1994; Woolnough, 1996; Rennie & Punch, 1991), which found that pupils decided to engage in an activity because they considered themselves to have the intellectual capability to undertake that particular activity. It also confirms the expectancy of achievement belief component of the Modern Expectancy–value Theory which regards one’s capability to be an important influence in decision or choice-making (Eccles, *et al.,* 1983; Eccles & Wigfield, 2002).

Some female pupils decided to join JETS Club because they wanted to associate themselves with other pupils who were in JETS Club already. The reason behind this desire was that JETS Club was perceived to be a club for intelligent pupils as some of the participants claimed. Because of this perception, pupils in JETS Club were thought to be intelligent as well. Therefore, some female pupils believed that by joining JETS Club, they would also be regarded as being intelligent by other pupils in their class or in school. Another explanation for wanting to associate with pupils in JETS Club was that the female respondents were hoping that intelligent pupils in JETS Club would assist them so that they could also become intelligent. Respondents were also hoping that their status would be raised by being in the company of other pupils considered as being clever. The desire by participants to associate themselves with other pupils who were in JETS Club accords with a study by Fredricks, Alfeld-Liro, Hruda, Eccles, Patrick & Ryan (2002), which found that a desire to be in somebody's company influenced a decision to join a club.

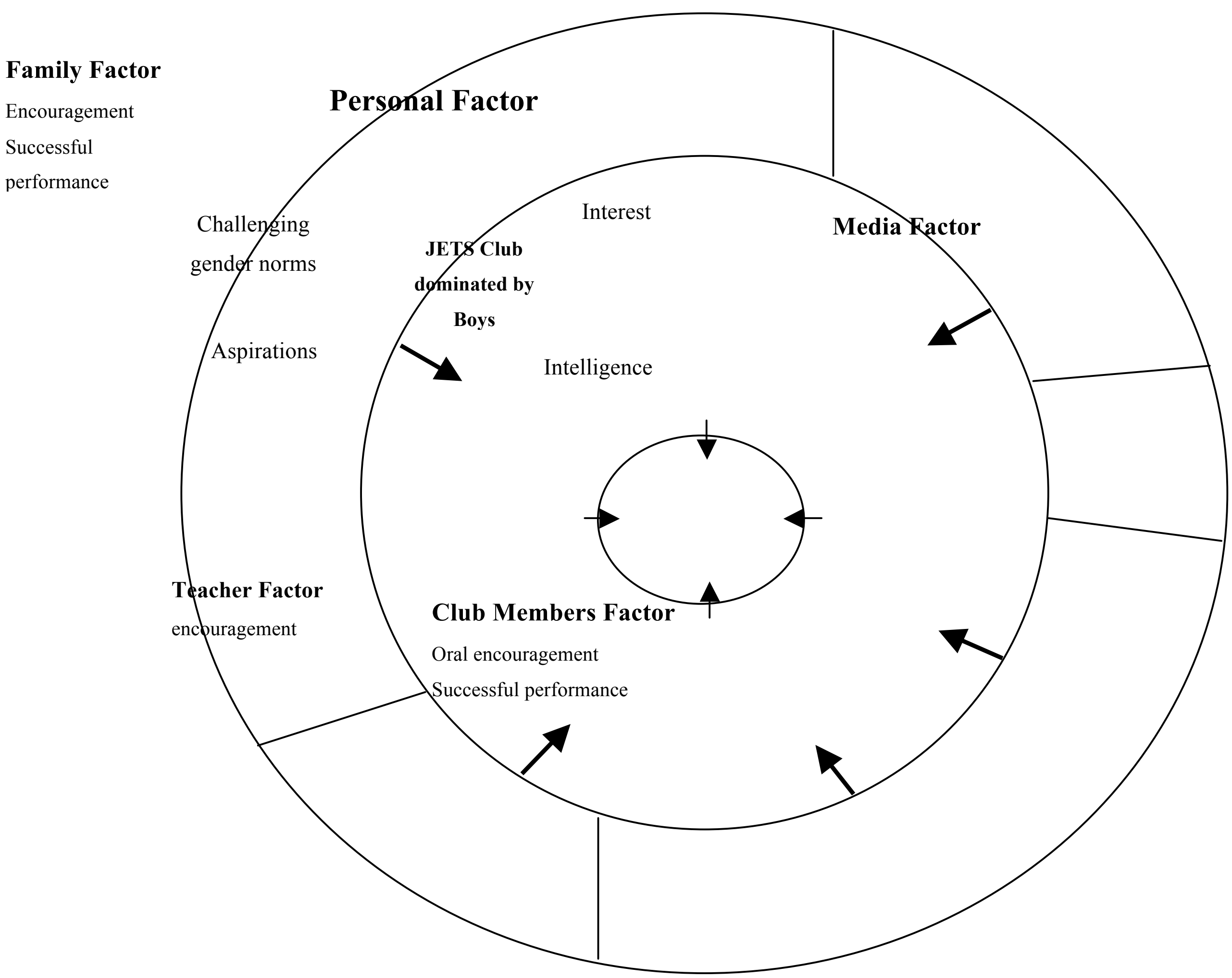
In addition, classmates' perception of JETS Club members as intelligent pupils also reinforced the desire of some participants to join JETS. They wanted to be considered as being intelligent too by others through being in JETS Club. Another intelligence related encouragement to join JETS Club came from some family members. In this regard, some of the participants were told by some of their family members that they had the mental ability to engage in activities done in JETS Club. This sentiment raised female pupils' confidence. This accords with the 'social persuasion' aspect of Bandura's theory which states that encouraging talks influence people's decisions or choices (Bandura, 1986).

5.1.5 Media factor

Some female pupils were motivated to join JETS Club because of the influence of the media, specifically through television programmes they were watching and books they read. This influence could be explained by the fact that a lot of pupils (particularly those living in Lusaka, the capital city of Zambia where the study was done) had access to television in their homes. Some of the television sets had a number of channels, such as the national geographical channel, which showed scientific documentaries. Similarly, the number of scientific books had also increased such that a good number of female pupils had access to them. The influence of electronic and print media on female pupils' decision to join JETS Club is in line with findings of Boe and Henriksen (2011) who found that both secondary and tertiary students were influenced to choose physics by watching television as well as reading biographies of famous people in science. While this was the case for female pupils living in the capital city of Zambia, it is not known if the female pupils who join JETS Club in other parts of Zambia are influenced by television, considering that access to it is limited, especially in rural parts of Zambia. Studies (e.g., Kelly *et al.,* 1999; Mwase *et al.,* 1999) have also shown that the house chores limit girls' time to do other things, which include watching television. However, it has been argued that the influence of the media is not always positive in encouraging female pupils to participate in science, technology, engineering and mathematics activities. In this regard, Arztmann and John (2008) assert that the media promotes stereotypes of various social categories, hence exerting force on female pupils to comply with female stereotypes. Similarly, some science print media still contain more of the 'he' than 'she' implying that STEM is mainly for males. Media pictures have also been perceived as promoting gendered stereotypes (Adya & Kaiser, 2005). Along the same line, Hymlo (2006) argues that films targeting girls do not often promote traditionally masculine careers, instead they promote careers which emphasise outlook such as fashion. Similar sentiments have been expressed by Steinke (2005).

From the discussion of the outcomes of this study, concerning factors which might have influenced female pupils' decision to join JETS Club, it can be deduced that the factors which emerged from the responses given by participating female pupils are interrelated and can be considered to be '*Zones*'. The major factors influencing decisions are internal assets or personal motives from the inside of the person (namely, challenging gender norms, aspirations, interest in science and recognition of intellectual ability). The personal factors were in turn strengthened by or came from external influences, namely, family members, peers, club members, school and the media. Figure 7 shows an emerging scheme which has been referred to as *'Zones of factors influencing female pupils' decision to join the JETS Club'* , displaying the relationships between the various categories of influence on female pupils' decision to join JETS Club.

Figure 7: Zones of Factors Influencing Female Pupils' Decision to Join the JETS Club



Source: Field Data

Figure 7 may be explained as follows: The centre circle represents the JETS Club, the domain which in most schools is dominated by male pupils, but which some female pupils decide to join. Surrounding the centre circle is the personal influence zone, consisting of internal motives (i.e. challenging gender norms, aspirations, interest in science and recognition of intellectual ability) which directly influence female pupils' decisions to join the club. The outer sphere consists of five zones representing family, peers, club members, teachers and media factors. The five zones of factors comprising the outer circle have an indirect influence on decisions made to join JETS Club by female pupils. Variations in the sizes of the zones in the outer circle indicate or reflect the frequency mentioned of these factors by participants. The most frequently mentioned external factor was family, followed by club members, peers, teachers and media as shown in the sizes of the zones. Personal factors were mentioned much more frequent than external factors. This can be interpreted to mean that participants were influenced much more by internal factors than external factors The arrows show the direction of influence in relation to JETS Club. In this case, they point towards JETS Club, thus representing a positive decision towards JETS.

5.2 Discussion of findings related to paybacks of participating in JETS Club activities

Improved understanding emerged as a benefit of participating in JETS Club activities. The enhanced understanding experienced by participants came in different ways. One of them was through interaction with various people such as pupils, teachers and outsiders during within school and inter-school JETS fairs involving pupils from different parts of the country . Another way they acquired more knowledge was through attending paper presentations and quiz sessions during JETS Fairs at school, regional and national levels during which participants shared knowledge. Listening to presentations of projects also contributed to enhanced understanding. This thinking is supported by Commonwealth Organisation (1995), which points out that pupils could also benefit from exchanging ideas with their fellow pupils from other schools. Researching for project ideas and while working on a project also contributed to their enhanced understanding. Their understanding of issues could also have been broadened through participation in lessons conducted by fellow JETS Club members. Freedom to ask questions and seek clarification was an important situation which facilitated acquisition of more knowledge as some participants submitted. Participation in extra-curricular activity has been reported by others (e.g Nchesi, 2001; Das, 2004) to contribute to knowledge acquisition by participants. Furthermore, significant increase in knowledge through participating in science club activities was reported among female pupils in India (Misra *et al.,* 2013).

The knowledge which female pupils acquired through participation in JETS activities made them to understand better what they were taught during time-tabled SMT lessons. One explanation for this is that the presentation of the same topic by fellow pupils was easier to follow than that made by teachers. Another contributing factor was that, in some cases, a topic was taught first in JETS Club and then taught again during formal lessons. Thus, since they had some ideas about a topic from JETS Club presentations, they were able to follow easily the presentation by the teacher. Furthermore, advanced treatment of a topic in JETS helped them to understand the topic in class. Improved understanding of sciences and mathematics taught during time – tabled lessons as a result of participation in science based extra-curricular activities has also been reported by other researchers (see e.g, Mannion & Coldwell, 2008; Agholor; 1994; Eastwell & Rennie, 2002; Vingilis-Jaremko & Vingilis, 2004) in other countries.

Participants also experienced an improvement in their examination performance in science subjects through involvement in JETS Club activities. The improvement in performance was due to the fact that some of the discussions during JETS meetings, centred around understanding and answering past examination papers. Participants therefore developed knowledge and skills of tackling questions successfully during examinations. Enhanced attainment also came from better understanding of the subject matter which they acquired from participating in JETS activities. Another factor which contributed to improved examination results was the confidence acquired in dealing with challenging and competitive situations and wide reading. Improved performance in examinations emerging from participation in JETS Club accords with findings of Agholor (1994), Clewell and Darke (2002), Fashola (1998) and Nchesi (2001), who found that participation in science based-extra-curricular activities resulted in improved examination results among participating pupils. Outstanding performance of JETS students against non-JETS science and arts students in the attainment of scientific literacy as well as in the attainment of technological literacy in Nigeria has also been reported by researchers (see e.g. Duyilemi & Oluwatelure, 2012). However, it is not clear whether or not these students were females or males. Some participants acquired more information on careers they intended to pursue in future. The knowledge of different types of science and technology-based careers were acquired through two ways, namely, through interaction with club members with similar career interests and through guest speakers invited to address JETS Club members. This is very important because female pupils will be able to make informed decisions regarding science-based careers. Improved career knowledge resulting from participation in JETS Club is in agreement with Eastwell and Rennie's (2002) study which showed that participation in science and technology based extra-curricular activities improved pupils' awareness of careers in science and technology fields.

There are several explanations why some of the participants experienced improvement in social, thinking and communication skills. One explanation with respect to social skills acquisition is that, through JETS activities, members interacted a lot with other club members within the school and outside the school at regional and national JETS fairs. Through this exposure, they met other people and acquired interpersonal skills. On the other hand, acquisition of thinking skills could be attributed to the nature of tasks in JETS which require and encourage members to be mentally active. Coming up with a good project, researching for quiz questions and Olympiads, requires one to engage in creative and quick thinking.

Acquisition of thinking skills through JETS activities supports the observations of Reddy and Savage (2004), who stated that participation in extra-curricular activities such as fairs stimulated a person to think beyond what one normally does. The finding is also in line with Das (2004) and Nchesi's (2001) observation that pupils who participate in science club activities develop creativity. This is a kind of thinking which involves coming up with something new, which is badly required in Zambia among both female and male members of the population for national development. Development of communication skills as a result of participating in JETS activities can also be explained in several ways. One explanation is that pupils acquire this skill through presenting lessons during JETS Club meetings. Participants made deliberate efforts to develop their oral skill because they were expected to speak well when explaining their projects to adjudicators and other people during JETS fairs. This finding agrees with studies which reported that acquisition of communication skills was one of the benefits of participating in extra-curricular clubs (Heaney, 1995, Gray & Nchesi, 2004, Science in School, 2007).

Development of confidence, motivation to study and a competitive spirit were also cited by some respondents as outcomes of participating in JETS Club activities. Development of confidence was due to increased knowledge and skills female pupils acquired during JETS activities, and the opportunities they are given to present lessons and papers to other people as well as explanations about projects they display to various people during JETS fairs. Confidence came about because of successes such pupils achieved in various JETS activities such as projects, quizes and Olympiads. Acquisition of confidence supports previous studies done elsewhere which linked development of confidence to participation in science club activities (e.g. Agholor, 1994; Andres, 2002; Clewell & Darke, 2000; Fashola,1998; Mannion & Coldwell, 2008; Molly & Mronson, 2006). Development of confidence is good particularly for female pupils, in that, it is one of the important attributes for scientific development (Yoloye, 1999). It encourages them to try new ideas and break new grounds.

Development of motivation to study came about due to the fact that JETS activities such as projects, quizes, paper and lesson presentations require one to search for information to enable him or her to perform well in these activities. Club members are also encouraged to look for information on their own. In addition, tests given in JETS Club also propel them to learn more so as to perform well. Along the same line, Fabiano (1998: 146) asserts that participation in "science clubs, competitions…and science fairs play a role in changing attitudes to learning". Pupils are motivated to learn on their own. Development of a competitive spirit by female pupils in JETS is due to the competitive nature of most JETS activities. Club members compete with each other at school, regional and national levels and, in each of these competitions, each one aims at being the best. Competition is good in the sense that it encourages pupils to work hard as well as aim for good quality projects. In reviewing related literature, no information was found regarding the association between a competitive spirit and participation in science-based extra-curricular activities. Nevertheless, a study by FEMSA conducted in Cameroon, Ghana, Tanzania and Uganda reported that teachers, parents and pupils were of the view that participation in SMT-related fairs, and competitions would improve female pupils' participation and performance in SMT subjects (FEMSA, Dissemination Report No. 13). On the other hand, Ekine and Abay (n.d.) hold the view that competitions are not the most appropriate way to motivate the participation of female pupils in science because they are not confident in science. Thus, minor losses will make them give up.

Development of independence also emerged as one of the benefits of joining JETS Club. One explanation for development of independence among some respondents is that members of JETS Club are encouraged to do things on their own. For example, they teach each other and they have to search for information on their own to come up with a project. This discovery is in agreement with those of Nchesi (2001) and Heany (1995) who revealed that pupils who participated in science club activities developed ability to do things on their own. Acquisition of ability to handle stressful situations by female pupils engaged in JETS Club activities could be attributed to the fact that there are certain times when a project does not work well, and it has to be improved within a short period of time in order to meet a deadline. Furthermore, due to the competitive nature of JETS Club activities, members sometimes experience defeatism which they have to put up with. Being a member of JETS, therefore, trains a person to manage loss. This accords with observations made by Nchesi (2001) that female pupils who participated in science club activities developed abilities to accept loss.

5.3 Discussion of findings related to challenges of participating in JETS Club activities

Most of the opposition against female pupils' desire to join JETS from the family came from their brothers. There are several explanations on why family members, in particular brothers, felt that female pupils were not suitable enough to be in JETS Club. One reason why brothers were against their sisters joining JETS is that they were of the view that JETS Club activities involved science and technology in which female pupils were generally, considered by males and society at large not to be good in (Erinosho, 2001a; Mwase *et al.,*1999) and therefore, they could not cope with the tasks. Another reason behind the negative attitude of brothers was that activities such as coming up with a good project required creativity, associated to some extent, with high cognitive ability which they thought female pupils did not possess. Furthermore, activities such as quizzes involve thinking, calculations and quick responses, which require someone to be brainy. Olympiads also require analytical thinking. Brothers felt challenged by their sisters joining JETS Club, which was generally perceived as a club for males. Some fathers of certain participants did not endorse their daughters' joining of JETS Club because they were of the view that it would not help them to follow the careers they (fathers) were in. However, despite so, they failed to dissuade their daughters away from joining JETS Club. The finding that the father of one participant failed to influence the daughters decision not to join JETS Club contradicts the findings of Liston, Peterson and Ragen (2009), who found that fathers had strong influence on decisions made by their daughters to participate in an informal programme such as JETS Club activities.

However, these girls demonstrated determination and resilience (i.e. ability to handle discouraging situations) in connection with their decision to join JETS Club such as rejection, negativity and challenges. One way they proved that they were resilient was where some respondents submitted that once they made a decision and regarded that decision correct or beneficial in one way or another, they could not reverse their decision even when they were discouraged by relatives and friends. Another way they demonstrated resilience was by their determination to join JETS in the face of negativity from other people. In other words, they were tenacious or persistent. With the resilience they had, they were able to overcome even negativity from family members. There is a tendency for girls in general, to give up when discouraged. The fact that these female pupils did not give up demonstrates how different they were from the rest of the girls. The implication of this is that female pupils should be encouraged to resilient in order to succeed in male stereotyped activities. Studies undertaken on females in STEM-based careers usually dominated males, found that these females were persistent, determined to achieve their goal even when they encountered discouragements from other people (Reddy, 2001; Beseke & Reilly, 2006).

Some participants also experienced negativity regarding joining JETS Club from their sisters and uncles. In this regard, participants claimed that their sisters did not support their decision to join the club because they believed that they did not have the mental ability required to engage in JETS Club activities successfully. The girls dealt with this negativity in two ways. Some female pupils told their brothers or sisters who were against their decision to join JETS Club that they were just wasting their time discouraging them and that the negative sentiments did not change their wanting to join JETS Club. They said that no matter what negative things they said against JETS Club, they would still join the club. Thus, they took an assertive approach to deal with negativity (i.e., they expressed their desire to join JETS strongly and with confidence) so that certain family members come to know their position regarding joining JETS Club. Other respondents simply listened to negative sentiments and ignored them without saying anything and joined the club. It could be said that they used a passive resistance or non-aggressive approach to deal with negativity. One explanation for having chosen to deal with negativity in this way was that society in Zambia expects girls to be seen and not to be heard. That is, they are not encouraged to talk so much by the socialisation process (Kelly, *et al.,* 1999). A similar belief has also been reported in Nigeria (Jegede, Agholor & Okebukola, 1996) and in other countries in Africa (see e.g. FEMSA, Dissemination Report No. 5).

Some female pupils also had to deal with negativity regarding joining JETS Club from peers. Participants said that their friends did not support their decision to join JETS Club because they were of the opinion that JETS activities were too demanding for female pupils, both in terms of time and intellect, in that they would be learning things out of the prescribed content for their level and also trying to come up with new ideas for their projects. Analysis of data provided by participants revealed that female pupils used similar strategies they used when dealing with negativity from family members. In this case, they used three approaches to deal with this negativity from their friends. One way they used to deal with negative comments about their desire to joining JETS Club was the assertive strategy. In this regard, they told their friends that they would join JETS at any cost because of the interest they had in the club, and also the value they attached to it as a good means for achieving their career plans. Thus, they expressed their desire clearly and forcefully to their friends, about their wish to join JETS. What this means is that if female pupils have to participate in male dominated activities, they have to be assertive.

The second way some respondents dealt with disapproval from peers was to quietly and gently ignore the discouraging sentiments and join JETS; a strategy which has been referred to above as 'passive resistance' to negativity. The third strategy used by other respondents to handle negativity from friends was to part company or keep away from friends who disapproved their desire to join JETS Club, contrary to the common saying which says “if you cannot defeat them, join them”. They decided to keep away from such friends so that they could no longer get discouraging utterances from pupils who were anti-JETS. For these participants, they saw more benefits of being in JETS Club than costs (Eccles, et al., 1983; Eccles & Wigfield, 2002). Similar strategies (such as ignoring others or challenging them) for dealing with negative messages from other people by female pupils in connection with participation in STEM related activities, have been reported by Grossman and Porche (2014).

Some of the participants also demonstrated determination to belong to JETS even when senior female members of JETS Club were hostile to them during their first JETS Club meetings. Hostility by old female members in JETS arose from the fact that these female pupils already in JETS Club enjoyed the status of being the only or the few ones in the JETS Club. Thus, with more female pupils joining the club, they felt that the status they were enjoying in the school would be eroded down. Furthermore, in recent years, there has been a lot of talk in schools and outside school, about certain rights every human being including females are expected to enjoy. These rights are referred to as ‘human rights’. One of these human rights for girls is access to education, including science and technology education (MoE, 1996). Thus, the new female members of JETS Club were of the view that they also had the right to be in JETS Club even when they were in lower grades in the school. Therefore, they made every effort to fit in the club. This group of female pupils had also to overcome resistance to their being in the club from male members. Some male members opposed the coming in of new female pupils in the club because they male-typed JETS Club, and therefore did not want to interact with female pupils because they regarded them as intruders in the boys’ club. In the terms of the Modern Expectancy -value Theory, the above mentioned negativities could be referred to as ‘costs’ associated with the decision (Eccles, *et al.,* 1993; Eccles & Wigfield, 2002).
The challenge of balancing time between JETS activities and other activities arose from the fact that JETS Club members need a lot of time to work on their projects, however they also need time to work on tasks given to them during classes by teachers and other issues, such

as revisions for examinations if one was in the examination year. This caused anxiety in terms of dividing time, because in some cases female pupils belonged to more than one extra-curricular club. Worse still, for day-scholars, issues of balancing time were more complex because they were also required at home, at the time they were expected to be engaged in JETS Club activities. In Zambia, domestic chores are considered to be a responsibility of girls and not boys (Kelly *et al.,* 1999). It is also the case in other African countries too. For example, a study by Nassor undertaken in Tanzania revealed that after school, 92% of the girls had domestic chore responsibilities compared to only 7% of the boys (Nassor, 2001b).

The expectation of female pupils to take responsibility for household chores, compared to male pupils not needing to engage in such duties is unfair to female pupils in a number of ways. One, it denies them the opportunity to write their home-work and study while male pupils have all that time; it makes them experience challenges in participating in extracurricular clubs such as JETS Club, which are more useful in enhancing their learning while boys have all this opportunities. This has contributed to some female pupils not joining JETS club or dropping out of JETS altogether. It also makes them get exhausted such that they lost the ability to concentrate during lessons especially in cases where they are made to work before going to school (Kelly *et al.,* 1999). Studies undertaken in Zambia and other African countries have cited homes chores as factors which contribute to poor participation of female pupils in science and technology activities (Mwase *et al. ,* 1999; Nassor, 2001b).

Another challenge which emerged relates to the negative attitude of male club members towards female members. Male members of JETS did not want to share knowledge with female pupils. This was expected because most male pupils erroneously took JETS Club to be a club for male pupils only. In Zambia, boys believe science and technology are their area and do everything possible to keep females away (Mwase *et al.,* 1999). Therefore, they refused to accept the participation of female pupils. One explanation for this behavior is that male pupils held the belief that the presence of female pupils in the club would lower the prestigious image associated with the club. They also questioned the ability of female pupils to engage in JETS activities independently. In reviewing the literature, no data was discovered on the attitude of male pupils towards female pupils in a science club. However, literature from other countries seems to suggest that even in ordinary classroom situation, male pupils demonstrated negative attitudes towards female pupils and, in some cases, male pupils did not consider female pupils as having the same ability as them (Nassor, 2001a). The unfriendly behaviour of male pupils towards female pupils in the use of equipment such as computer in class has been reported by Acker and Oatley (1993). They reported a situation where no materials and knowledge were shared between male and female pupils in the same class.

Some teachers also contribute to the downgrading of female pupils. For example, they do not defend girls when boys behave in a negative manner towards female pupils. Teachers are in a position to ensure that female pupils are treated fairly by male pupils. Studies have also shown that teachers' assumptions and anticipations of female and male pupils are vital (Anderson, 2012; Huang & Fraser, 2009; Kahle & Meece, 1994; She & Fisher, 2002). Although teachers when asked, state that they have the same expectations on female pupils and male pupils, that is good attainment in science subjects, however their classroom interaction with these two groups of pupils suggest the opposite (Kahle, Anderson & Damnjanovic, 1991; Kahle & Meece, 1994). For instance, female pupils receive less attention than male pupils from teachers (Baker, 1998), and also, they are not motivated as much as male pupils to become involved in science (Dimitriadi, 2013). Teachers tend to encourage male pupils to experiment and be innovative while they ignore female pupils (Nassor, 2001a). They also do not give guidance to female pupils during lessons (Welty & Puck, 2001). Furthermore, this kind of interaction between the teachers and both groups of pupils is further carried over to extra-curricular activities such as JETS Club, which is unfortunate on the side of female pupils. Some studies e.g. Kelly et al., (1999) have revealed that some teachers have low expectation of their ability in science and mathematics.

Another challenge is that female pupils found it difficult to compete with their friends in the same class in areas such as project work. This may not be strange because it has been observed that, generally, girls, like to co-operate among themselves (Lenga, 2001). This view is in line with Mulemwa's (1999a) observation that female pupils like to co-operate rather than to compete. Brickhouse, Lowery and Schltz (2000) also pointed out that female pupils did not like competitive environments. However, this perspective is no longer the case because there are now a good number of girls who enjoy competing with other female pupils. Others want to compete with male pupils as some of the respondents in this study stated. A competitive spirit even with class-mates or school-mates is healthy for female pupils, because it would help them to develop further. Therefore, competition should be encouraged among girls as well as between girls and boys.

One other challenge was what female pupils perceived lack of support from the school management in general, and in particular, from JETS Club patrons. The non-supportive nature of some school mangers to JETS Club can be explained in a number of ways. These are as follows: lack of understanding of the value of JETS Club to pupils since what they do in this club is not examinable; lack of interest in STEM-related activities since the majority of head teachers in Zambian schools are not science or mathematics teachers; perceived high cost of materials required for JETS Club activities; JETS Club activities not as being exciting as other games to the whole school; and sometimes poor performance by pupils during inter-school JETS fairs. With regard to female pupils, some head teachers think that JETS Club is not their club while others hold the view that JETS activities are not important since they are just voluntary activities.

The observation by some female pupils that they were not receiving adequate support from patrons/matrons was cited by a science standards officer, who submitted during the interviews that female pupils lacked support from club advisors due to heavy workloads of advisors or sex differences. As such, some patrons did not represent the needs of the club adequately to the school management. This is not good in the sense that patrons were expected to be more supportive of club members. In the same line, Fancsali and Froschl (2006) argue that occasions for female pupils to experience helpful relationships as well as moral support are essential in promoting female participation in STEM-related activities. One explanation for this lack of support from patrons could be that generally, being science or mathematics teachers, they had heavy teaching loads in some schools which allowed them very little time to provide adequate guidance to pupils during extra-curricular activities in the afternoon. However, this factor may not adequately explain the situation because even pupils attend many lessons in the morning. Another explanation for lack of support from patrons could be that some schools had two sessions (i.e., they had one group of pupils attending school in the morning and another group in the afternoon session). Some patrons taught in the afternoon when JETS meetings normally took place, hence they had little or no time at all to provide guidance to club members. Another factor was that since teachers were paid extra money for teaching in the afternoon and nothing for guiding pupils in JETS Club, some teachers/patrons opted to go for teaching afternoon classes instead of attending to pupils in JETS Club. Also some patrons/teachers opted to get involved in activities such as sports which were well supported by the school administration, and chances of getting an allowance were higher than being involvement in JETS Club. It could also be possible that in some cases, patrons did not understand their roles as JETS advisors, because some patrons were not trained or oriented as on how they should undertake their responsibility. Some also lost interest because of so many challenges they encountered in their discharge of responsibilities, and some cases lack of motivation from the system because the club was considered as an after-school activity. Furthermore, JETS activities require creative and innovative thinking to guide pupils, most of the patrons found this challenging. Hence, they were not able to provide the guidance pupils needed. The lack of support from patrons/teachers to female pupils supports the views of Welty and Puck (2001) ,who found that teachers did not make attempts to guide female pupils during technology lessons.

However, in some cases, patrons did not expect much success from female pupils because of their stereo-typing of female pupils' abilities (Kelly *et al.,* 1999). They still held wrong beliefs that female pupils were not at the same level intellectually, with male pupils, a perspective which has been said to be incorrect by some researchers (see e.g. Dimitriadi, 2013; Weinburg, 1995; Duyilemi and Oluwatelure, 2012). One male JETS patron interviewed revealed that some female pupils found it difficult to consult male patrons for help in a situation where there was no female. This is because they were afraid of being accused of being in close relationship with the teacher. It is also noted that in some cases, teachers have been reported of going beyond their professional roles with female pupils (Kelly *et al.,* 1999).

What seems strange is that although these female pupils experienced all these challenges, they did not leave the club but continued to be members. They indicated that what made them to remain in JETS Club were the following: the desire to get good results in final examinations, particularly in the SMT subjects; an improvement in performance in SMT subjects in which they were experiencing difficulties; the drive to research and study harder; learning new things they did not cover in time-tabled lessons. Furthermore, the desire to accomplish their future aspirations as well as various aspects of science and JETS activities, female pupils found it prudent to join JETS.

According to responses given by participants, female pupils decided to join JETS Club because of *self-perception of their capability or ability* to engage in JETS activities, *interest* in JETS Club activities, *usefulness* of JETS Club activities as a means to achieving future aspirations. However, participants also encountered challenges in numerous forms i.e. costs. All these aspects reflect the Modern Expectancy-value Theory advanced by Eccles, *et al.,* (1993). It, therefore means that the Expectancy-value Theory has been corroborated to a large extent by the current study.

The current study has also established that some female pupils were influenced to join JETS Club because of being *persuaded* by other people such as family members, JETS Club members and teachers. Some were influenced by the *successful performance* of others, such as family and JETS Club members. It therefore means that the Self-efficacy Theory advanced by Bandura (1986) has been corroborated by the findings of this study to some extent. However, the task performance component of the Self-efficacy Theory has not been reflected in any of the responses given by participants in this study.

Some female pupils decided to join JETS Club, which is dominated by male pupils in co-education schools and hence perceived to be a boys' club, because they were of the view that they had the *same intellectual ability* as male pupils in JETS Club. Thus, the liberal feminist perspective has been corroborated. According to this viewpoint, both females and males have the same mental ability. Other female pupils who participated in the current study said that they decided to join JETS Club because most of the scientific discoveries were made by men, which they thought was not good. So they wanted to participate in JETS Club activities so that as females, they can make some scientific discoveries as well. Thus, this finding has to some extent corroborated the radical feminist perspective which posits that females should be involved in the generation of scientific knowledge also.

This study has brought to light that there are female pupils in Zambia who do not order their lives by communal consensus, that is, they do not make decisions in line with social-cultural expectations. Furthermore, even when some members of society as well as family members expressed their disapproval of their decision, they did not change.

Although in the current study, one participating school was located in the rural area while the rest of the participating schools were located in the urban areas, the responses female pupils gave in relation to what might have influenced them to join JETS Club; benefits of participating in JETS activities as well as challenges they encountered in JETS Club are similar. This is because the school in the rural area is a boarding school and the majority of these pupils are from Lusaka urban where the rest of the three schools are located. Therefore, they have a similar experiences and aspirations.

5.4 Discussion of findings related to why some female pupils avoid JETS Club from the perspective of female pupils in JETS Club

Participants were of the view that some female pupils were not members of JETS Club because they considered this club as a club for male pupils. There are several explanations for this kind of belief. One reason is that science and technology are stereotyped as subjects for male pupils by society at large (Erinosho, 2001; Nassor, 2001) and therefore, some pupils take this as a truth. Therefore, since most activities in JETS Club are scientific, mathematical and technologically-based, they avoid joining it. Another explanation on why most female pupils regard JETS as a club for male pupils is that, in most mixed-sex schools, most JETS Club members are male pupils. This gives the club a masculine image to most female pupils. The view that female pupils consider science, mathematics and technology as areas for males only has also been reported by Mwase, *et al.,* (1999) in Zambia as well as in other countries such as Nigeria and Uganda (see e.g. Okebukola & Agholor, 1991; Mulemwa,1999a).

The perception that tasks undertaken in JETS Club were difficult is believed by some female pupils in JETS Club, to have caused some female pupils to keep away from JETS Club. They perceived the activities as requiring one to have the brain-power to undertake them. A number of reasons contribute to this perception about JETS Club. One is that most of the pupils who joined the club in both mixed and single sex schools were perceived to be intelligent by other pupils. Another explanation for this perception is that most JETS activities involve mathematics, science and technology, which are considered as subjects for high-achievers. Therefore, a stereotypical image is created among female pupils that JETS is for those who are intelligent. This belief is in line with the findings of Adamuti-trache (2006), and Mulemwa , (1999b) who state that female pupils find science, mathematics and technological activities difficult.

Non-science related aspirations were also believed, by female pupils in JETS Club to have created lack of desire by some female pupils to join JETS. They regarded JETS as less useful to achieve their future career plans. This is in line with the pattern established by Clewell, Anderson and Thorpe (1992), Rosser (1990), as well as Gatta and Trigg (2001), that female pupils avoid participating in science and technology-related activities if their future desire is to pursue a non-science-related career. The aspiration for non-science-based career by female pupils is supported by a large section of society in Zambia which believes that science and technology-based careers were not appropriate for females. Therefore, this section of society does not encourage females to pursue science, technology and mathematics. Females pupils are led to think this way, because there are very few females who are in science-related careers in comparison to males.

Another issue which emerged as having contributed to some female pupils not to join JETS Club was reported to be lack of self-confidence, that they could undertake JETS activities successfully. This thinking supports the findings of Mwase *et al.,* (1999), Clewell, Anderson and Thorpe (1992), Gatta and Trigg, (2001), who reported that some female pupils had a negative perception of themselves to learn science and mathematics. Lack of self-confidence among some female pupils arose from a number of sources. One source is the negative messages from some family members and teachers on their abilities to succeed in science, mathematics and technology (Kelly *et al.,* 1999). As a result of the low self-confidence to undertake JETS activities, they decided to keep away from these activities. Low self-confidence also comes from poor performance in subjects such as science, mathematics and technology around which activities in JETS Club are centred. Lack of self-confidence has also been reported to have contributed to low participation of female pupils in science subjects (Gatta & Trigg, 2001; Mwale et al., 1999). According to the Self-efficacy Theory, self-confidence is an important factor in making decisions or choice, to join a club or not (Bandura, 1986).

Lack of interest among some female pupils in JETS activities was also thought to be contributing factor to their not joining JETS Club. Lack of interest came from various sources. One source is lack of interest in science, mathematics and technology subjects which may have been transferred to JETS Club, since it is a science, mathematics and technology based club. In Zambia, most females have been reported to have no interest in SMT subjects (Mwase *et al.,* 1999). Lack of interest also originates from the perception that JETS is not of any use at all, and participation would be merely a waste of time. Lack of interest in JETS activities also comes from the perception, that these activities are difficult to do, negative information spread by other pupils, teachers and in certain cases, family members as well. Interest is an important factor in influencing decisions or choice to join or do something as the expectancy-value theory states (Eccles & Wigfield, 2002; Wigfield, 1994). Lack of participation of female pupils in science subjects has also been attributed to not having interest in science (Hill, et al.; 1990). This finding means that efforts must be made by all those responsible for JETS Club to make the activities appealing to female pupils.

Lack of information or knowledge about JETS Club and the usefulness of its activities also came out as one reason why some of the female pupils were not members of JETS Club. This indicates that JETS Club and its activities were not well published in some schools especially among female pupils. In some cases, information was shared but most of it was negative about JETS Club which, was not motivating to some female pupils. It has been observed that lack of access to information about what are termed to be 'hard' sciences as well as off-putting and unfair information has contributed to female pupils not choosing such sciences (Dimitriadi, 2013). The perception that some female pupils did not participate in JETS activities because of lack of knowledge about the club is in line with that of Rosser, (1990) as well as Gatta and Trigg (2001) who found that lack of knowledge about the usefulness of science subjects contributed to poor participation of female pupils in science subjects . It therefore reveals that not much is being done in schools to make female pupils aware of what JETS Club is.

CHAPTER SIX

CONTRIBUTIONS AND IMPLICATIONS OF THE STUDY

6.1 Contributions of the study to knowledge

Participation in extra-curricular or free-choice learning activities has been reported to be a good avenue for learning by both female and male pupils. It is, therefore, important that both female and male pupils equally participate in these activities. The present study arose from the researcher's concern about the relative small number of female pupils in science, mathematics and technology-based extra-curricular club known as JETS in Zambian schools. The researcher got interested in female pupils who were in JETS Club since he wanted to understand them and about their experiences in the club. The information generated through this study, could then be used to find ways of encouraging more female pupils into the JETS Club.

Thus, the purposes of undertaking this study were fourfold: first and foremost to understand what might have influenced female pupils in JETS Club to decide to join the club, which is science-based and dominated by male pupils in most Zambian schools; second, to understand benefits such members got for participating in JETS activities; third, to understand the challenges (if any) encountered by female JETS Club members; fourth, to understand what female pupils in JETS Club thought were factors which might have influenced some female pupils not to join JETS Club. Concerned people may not be able to effectively increase the number of female pupils joining JETS Club unless they understood these issues.

An extensive review of related literature established that no studies addressing the issues above had been conducted in Zambia. Thus, there was a knowledge gap which made this study necessary. Since the present study was the first of its kind in Zambia, its findings have made a number of noteworthy contributions to the understanding of factors which might have influenced female pupils to decide to join JETS, the benefits and challenges of being in JETS Club as well as factors which might have made some female pupils avoid joining the Club. These contributions to knowledge are outlined below:

6.1.1 Contributions to knowledge relating to influences on decisions to join JETS

With respect to factors which might have influenced female pupils decide to join JETS club in Zambia, the study has made the following contributions: first, it has established that female pupils who participated in this study decided to join JETS Club due to inner-self or personal influences. The personal motives identified by this study were to challenge gender norms (i.e., to show that female pupils were intellectually equal or superior to male pupils in SMT-based activities) and being useful in terms of accomplishing their aspirations such as to secure a scholarship, pursuing SMT-based careers, acquiring more knowledge in SMT subjects, in addition to what was covered during lessons. Others reasons were performing well in mathematics and science in final examinations; discovering something new; interest in science and experimental work as well as possessed self-concept of intellectual ability to undertake activities in JETS Club.

The second contribution to knowledge which this study has made, is that, it has established that apart from personal or internal motives, female pupils were also driven into joining JETS by external factors, which in some cases reinforced personal motives or were the basis for such motives. The external motives found to have influenced female pupils to join JETS came mainly from family members, peers, club members, teachers and the media.

The third contribution to knowledge the current study has made is to bring to light how such external factors influenced female pupils to decide to join JETS Club. In this regard, the study has suggested that in the case of family members (fathers, mothers, brothers and sisters), they influence female pupils' decision to join JETS through various ways. For example, by telling them that the club was not for boys only but also for girls and that it would be helpful to them in terms of accomplishing their aspirations, providing opportunities to learn more and facilitating them to perform well in examinations. Some family members also influenced respondents through demonstrating interest in science while others told the respondents that they had the intellect to undertake JETS activities.

The fourth contribution to knowledge the current study has made is to establish that peers, as an external factor also plays a role in influencing female pupils' decision to join JETS. The study brought to light the information that peers inspired female pupils to decide to join the club, for example, through a peer's good performance in class in mathematics and sciences. Peers also motivated respondents through verbal persuasion that is, encouraging female pupils to join by telling them that they would learn more and engage in experiments as well as through their (peers) perception of JETS as a club for intelligent pupils only.

The fifth contribution to knowledge, the current study has made with respect to influences on female pupils' decision to join JETS Club, is to bring to the fore the fact that in Zambia, JETS Club members also played a role in attracting female pupils to join JETS Club. Club members inspired female pupils to decide to join the club through what they did, such as receiving awards , scholarships they received, good performance they achieved in class, as well as the good projects they produced which were an inspiration to respondents. Furthermore, Club members also influenced female pupils through verbal persuasion, such as sharing usefulness of participating in JETS Club activities with female pupils, as well as advertising the club to female pupils.

The sixth contribution to knowledge the current study made, is the revelation that class teachers, as well as teachers in administrative positions, contributed to female pupils' decision to join JETS club through different ways, such as verbal persuasion as well. In this regard, they told female pupils that JETS Club was not for boys only but for girls as well. Teachers also shared information of past female pupils whose projects had won at the national JETS fair, and went overseas for further studies. Furthermore, by informing female pupils that they would achieve success in school in mathematics and science if they participated in JETS Club activities motivated them.

The seventh contribution to knowledge the current study has made is to highlight that the media also plays a role in influencing female pupils to decide to join JETS Club. In this regard, the study has suggested that female pupils got attracted to joining JETS because of the science television documentaries which they watched and the stories they read in books. Thus, female pupils were of the view that they would be able to do some of the things they saw on television programmes or read about in the book through JETS Club.

Another contribution to knowledge the current study has made, is to bring to light that Zambian female pupils who decide to join JETS Club in schools, have personal attributes which make them different from ordinary Zambian girls. The study has revealed that these female pupils have the following internal asserts: a belief that they are equal to male pupil or better than male pupils mentally. As such, they are competitive; resilient and have determination. These female pupils are assertive and they have interest in science and science related activities. These girls have high self-esteem and ambitions such as to pursue non-traditional careers or come up with something new. The personal traits of these female pupils are similar to those possessed by females in STEM-based careers (Reddy, 2001; Besecke & Reilly, 2006).

Finally, after taking into consideration personal and external influences together, this study has made a contribution to knowledge in terms of generating what has been called *'Zones of factors influencing female pupils' decision to join the JETS Club'*, which is an emerging scheme for explaining the relationship among various factors, which influences female pupils' decision to join JETS Club in Zambia. This scheme, from the records, has not been documented anywhere.

6.1.2 Contributions to knowledge relating to benefits of participating in JETS activities

The current study makes several contributions to the understanding of benefits which female pupils derive from joining and participating in JETS Club activities in Zambian schools. As a result of this study, interested readers will know that participation in JETS Club activities is beneficial to female pupils in a number of ways. These are, it leads to acquisition of more knowledge and improved performance in mathematics and science subjects, which result from wide reading and interaction with people from within the school and other places. Other benefits are acquisition of social, thinking and communication skills arising from interaction with other people as well as engaging in project work, which require a lot of thinking to come up with. Furthermore, participation in JETS Club activities leads to development of confidence, motivation to study and brings about a competitive spirit. It also results in development of self-reliance, focus and determination, as well as development of ability to handle difficulty situations such as loss in a competition. This knowledge is very useful because it can be used by various stakeholders to encourage more female pupils to join JETS Club. Teacher educators will also find this information valuable, for sharing with teachers undergoing training in science, mathematics and technology education fields.

The current study has also shown that for some participants, participation in JETS activities did influence or change other aspects of their lives. For example, some indicated that as a result of their participation in JETS Club activities, they were now able to respond in a much more friendly manner to requests from other people in communities they live in. Others indicated that their ability to communicate with other people in society improved through participation in JETS activities. Some participants indicated that through participation in JETS activities, they were able to carry out certain tasks at home which they were not able to do before. Participants also said that as a result of working in groups when under taking JETS activities, they had now realised the value of team-work in facilitating development in their communities. Some cited acquisition of sense of responsibility, resulting in them doing things without being supervised at school or at home, while others said that participation in JETS had encouraged them to start thinking about problems in their communities and how to find ways of solving them.

6.1.3 Contributions to knowledge relating to challenges of joining and participating in JETS Club activities

The study has also made known that female pupils who participated in JETS Club encountered challenges, namely: disapproval by some of their family members to join JETS Club; discouragement by some of their friends; sharing time between JETS Club activities and other equally relevant activities; negative attitudes by male club members; coming up with a good project; unwelcoming attitude by some of the JETS Club members; fitting in the club and inadequate time allocated to JETS Club by the school. Other challenges cited were negative comments made by other pupils on projects; lack of support from school management and patrons; biasness on the part of some patrons; complaints from teachers not associated with JETS Club; accessing information to get ideas on possible projects; lack of material resources for projects; low number of female teachers involved in JETS activities; unfairness in the adjudication process; making presentations during JET fairs; quality of awards given; learning advanced things; missing lessons and losing in competitions. Thus, this study has contributed to the understanding of challenges female pupils encounter as members of JETS Club, which are not documented in Zambia. This information can therefore be used to address some of the challenges female pupils in JETS Club experience so that they enjoy their being in JETS Club.

6.1.4 Contributions to knowledge relating to why most female pupils do not join JETS Club from the perspective of female pupils in JETS Club

This study has brought to light the fact that from the perspective of female pupils in JETS Club, most female pupils do not join JETS Club because of the following factors: perception that JETS is a club for male pupils; perceived challenging nature of tasks in JETS Club; future career aspirations not in STEM field; lack of self-confidence; lack of interest in science-related activities because JETS Club is STEM-based; self-perceived lack of intelligence required to engage in JETS activities successfully; things learnt in JETS Club considered to be the same as those learnt during time-tabled lessons; and lack of knowledge about JETS Club. Other factors cited were linkage of JETS Club to jobs perceived to be dirty by female pupils; JETS perceived to be boring compared to other clubs (such as drama) in the school; lack of support and encouragement from family members; discouragement from fellow pupils; fear of being in JETS Club; and non-provision of information on JETS Club by schools. This information is vital because it can be used to encourage more female pupils to join JETS Club.

From the information given above, the current study has successfully answered the research questions posed in chapter one of this thesis. In other words, the knowledge gap which made this study necessary, has arguably been filled.

6.2 Implications of the Findings

There are a number of implications arising from findings of the current study. Implications generated herein, simultaneously reveal recommendations of this study and, therefore, it is important to bear this point in mind, because there is no separate section on recommendations in this document.

6.2.1 Implications Relating to Increasing Numbers of Female Pupils in JETS Clubs

This study has shown that participation in JETS Club activities was advantageous to female pupils in several ways, and these advantages generate a number of implications. The first implication relates to the broadening of access of female pupils to science and technology-based extra-curricular clubs, which is related to one of the objectives of Project SUSTAIN under which this study was done. This study has shown that the most prominent influences in the decision to join or not to join JETS Club among female pupils, are the internal motives or assets within an individual female pupil. The implication of this finding, is that activities aimed at increasing the number of female pupils joining science and technology-based extra-curricular clubs such as JETS Club should target female pupils themselves, because they play an important role in making a final decision. This view is supported by Modi, Schoenberg and Salmond (2012), who assert that it is vital to foster female pupils' internal assets in addition to external factors.

In the current study, desire to prove that female pupils were intellectually the same or better than male pupils emerged as one of the internal motives for female pupils' decision to join JETS Club. In other words, female pupils wanted to challenge existing gender norms (i.e. the perception that science and technology-based extra-curricular activities are for male pupils only). The implication of this finding is that in order for more female pupils to join JETS Club, teachers and family members must encourage them, by telling them that scientific and technological-based activities such as JETS Club, are not for boys only but for girls too, and that they can also make it in JETS Club as boys do, because they have the same intellectual ability as boys do as liberal feminists argue (Sinnes, 2005). Furthermore, as the Self-efficacy Theory posits (Bandura, 1986), persuasion by significant others can contribute greatly to more female pupils joining JETS Club.

Another important message which comes from this study is that future aspirations (such as to secure scholarships, perform well in the examinations, pursue a science and technology based career) influenced female pupils to decide to join JETS Club. Some participants also said that some of the female pupils did not join JETS Club because their future career plans were not in the area of STEM. The implications of these findings is that in order to encourage more female pupils to decide to join JETS Club, there is need to talk to female pupils about the possible benefits of participation in JETS Club. That is, its usefulness in terms of enabling them to accomplish future aspirations. According to the Expectancy-value Theory, a person will decide to do something if he or she sees value in that particular thing (Eccles & Wigfield, 2002; Wigfield, 1994).

Interest in science, including conducting experiments and desire to engage in projects also emerged as one of the major internal motives behind female pupils' decision to join JETS Club. The implication of this finding is that if there was desire to increase the number of female pupils joining JETS Club, then JETS activities should be more experimental and project oriented than they were at the time of this study. Female pupils like a learning environment which gives them opportunities to actively participate in the learning process (Cole & Grffin, 1987; Ferreira, 2001). The reduction in the emphasis on the practical examination at the end of secondary education should not lead to doing away with practical work as a mode of teaching and learning. Teaching and examining should be considered as two separate processes.

The belief that female pupils had the intelligence to undertake JETS Club activities was one reason which influenced female pupils to decide to join JETS Club, while some female pupils were reported to have avoided joining JETS Club because they perceived themselves as being not intelligent enough. The implication of this finding, with respect to increasing more female pupils to join JETS Club, is that, there is need to increase the self-esteem of female pupils with regard to science and technology-based activities in line with the Self-efficacy Theory (Bandura, 1986). This could be done through providing opportunities to female role models in science and technology based fields to talk to female pupils, and providing more information through talks by teachers on females who have done very well in science and technology fields.

Other issues relate to the role played by outside influences on decisions made by female pupils. From the finding, it was clear that the social environment (i.e., family members, friends, club members, school administrators and teachers of female pupils) was also important in influencing female pupils' decision to join JETS Club. At the same time, some participants asserted that they experienced challenges from the social environment. The implication of this finding is that activities targeted at encouraging more female pupils to join JETS Club should include sensitisation of family members, peers, club members, teachers and school administrators to support female pupils' decisions to join JETS Club.

Encouragements from family members , peers, club members and the school should aim at influencing and supporting personal aspirations and interests of female pupils. In view of the fact that female pupils encountered negativity in their decision to join JETS Club, negativity originating from various groups in society should be explicitly addressed. Effort must be made to cultivate a sense of resilience and determination among female pupils to get into JETS, by various social groups, such as family members and teachers. Messages from teachers and family members concerning involvement in JETS Club can assist to cancel out stereotypical expectations, by promoting female pupils engagement in JETS Club. In the same vein, Myers, Jahn, Gillard and Stoltzfus (2011) assert that social groups, such as family members, teachers and other important people can, to a great extent, facilitate pupils' resilience by encouraging them to persist through things that are difficult. This oral persuasion is very important, in that it would raise their self-efficacy to join or continue to participate in JETS activities (Bandura, 1986). High self-efficacy also helps to overcome challenges encountered in the activities (Zeldin & Pajares, 2000). Low self-efficacy has been cited by participants in the current study as one of the issues which makes some female pupils avoid joining JETS Club.

Former JETS Club members, particularly female ones, should be invited to talk to pupils (as role models) so as to encourage more female pupils to join JETS. The purpose of exposing female pupils to female role models is to demonstrate to female pupils that females can make it in areas perceived to be for men alone. Role models are important, because lack of female role models in clubs perceived to be for males only has been cited as one of the challenges for female pupils in JETS Club, in that they have no one to emulate. Enhancing female pupils' participation in science-related extra-curricular activities requires role models (Pritchard, 2006). It has also been argued that female role models are important in raising young people's aspirations (Dimitriadi, 2013). Aspirations in turn influence decisions as suggested by the Expectancy-value Theory (Eccles & Wigfield, 2002). Efforts should be made to address the issues female pupils in JETS Club thought were contributing to some female pupils avoiding JETS Club.

6.2.2 Implications for development of life skills

Another implication arising from this study relates to development of skills necessary in life. The Zambian Ministry of Education requires that pupils passing through the education system acquire life-skills, which would enable them to lead a good life in future and also be responsible members of society ((MoE, 1996, 2000, 2001) . This is also the desire of the Project SUSTAIN, under which this study was done. Some of the life-skills cited by MoE (1996) as important for positive social behaviour and coping with life issues, are problem-solving, creative thinking, effective communication, stress and anxiety management, coping with pressure as well as self-esteem and confidence. Listening to what the girls in the current study said, it is clear that participating in this club enabled them to acquire foundation blocks for life skills such as knowledge, skills (like social, thinking, creativity, research, confidence, communication) and positive attitudes, for example desire to study and learn, independence, focus on a task, assertiveness and determination.

This study supports the idea that schools in Zambia should consider science-based extra-curricular activities as useful tools for female pupils to acquire life-skills. This, therefore, means that teachers and family members in Zambia should encourage more female pupils to participate in JETS Club activities. As Coffield (2000: 8) points out "informal learning should no longer be regarded as an inferior form of learning…it needs to be seen as fundamental, necessary and valuable in its own right…". A similar position was also taken by the National Council of Educational Research and Training of India, in its position paper on teaching of science. It observed that extra-curricular activities should not be regarded as minor components of the school programme because, they encourage inventiveness and originality (NCERT, 1996). This is what is required in Zambia to foster national development, which is required in a developing country like Zambia. Science based extra-curricular activities also contribute to enhancing scientific and technological literacy among pupils. For example, the JETS programme has been found to be important in helping pupils to acquire scientific and technological literacy amongst pupils in the programme in Nigeria (Duyilemi & Oluwatelure, 2012). Thus, in Zambian schools, JETS Clubs should be considered as being cardinal in promoting scientific and technological literacy among school pupils.

6.2.3 Implications for teaching and learning of SMT

This study has important implications for the teaching and learning of science in Zambian schools. One implication of this study relates to provisions of a variety of learning activities during the teaching and learning of science, mathematics and technology. From the submissions given by female pupils in this study, JETS Club provides a variety of learning opportunities such as quizzes, lessons conducted by fellow pupils, research, extended investigation and listening to papers being presented, which result in a number of academic benefits among female pupils.

Therefore, with regard to teaching and learning in an ordinary classroom in Zambian schools, the implications arising from the findings of this study are that activity-based methods should be used to teach science in order to enhance interest and learning for female pupils. Hands-on learning approach make science enjoyable and appealing to female pupils (Wellington, 2000; Hart, 2002; Fancsali & Froschl, 2006). In this regard: (a) teachers should give opportunities to pupils to research on a topic individually and in groups, and make presentations to their fellow pupils in the classroom; (b) when pupils ask questions or seek clarification on an issue, teachers should give chance to other pupils to respond or clarify the issue; (c) from time to time, teachers should engage pupils in quizzes to stimulate their thinking; (d) practical work, such as projects should be made available to allow pupils to demonstrate and explain products to other pupils; (e) teachers should provide opportunities to pupils to interact among themselves during lessons as well as provide opportunities for them to make presentations on particular topics to their friends (i.e. pupil to pupil learning should be encouraged); (f) chance should be given to pupils in JETS Club to share positive things about their participation in JETS activities so as to encourage others to join the club. Opportunities should be provided for co-operative learning which some female pupils like (Mathews & Sweeney, 1997; Fancsali & Froschl, 2006). Furthermore, field trips should also be part of teaching-learning activities. Learning science outside the classroom or school will help both female and male pupils see the relevance of science taught in the classroom to work place and daily life (Kahle, 1996). The attainment of female pupils is also improved.

6.2.4 Implications relating to minimising challenges encountered by female pupils

Female pupils in JETS Club encounter a number of challenges. The implication of this is that there is need to minimise these challenges if more female pupils are to join and participate in JETS Club activities as well as make the club female friendly in Zambian schools. One way of doing this is to talk to female pupils on management of time so that none of the activities they are expected to do as part of the school curriculum should suffer. Another thing that needs to be done by teachers in charge of JETS Club, is for them to talk to male pupils in JETS Club to accept female members as partners. Patrons can also support female pupils in JETS by identifying stressors such as discrimination, as well as stereotypes and giving assistance in dealing with these experiences (Sosa & Gomez, 2012). Support from patron or matron in the face of a challenge can overcome this difficulties (Grossman & Porche, 2013). It is also important for JETS patrons to talk to senior girls in JETS Club to welcome new female members of the club. Support by patrons or matrons to female pupils engaged in informal learning activities is important (Liston, Peterson & Ragan, 2009) because , internal motivation is improved when pupil feel supported (Ekine & Abay, n.d.). Furthermore, female pupils need a supportive environment to purse interests, task risks, not to fear to make errors and use mistake-making as a strategy of learning (Girls Incorporated, 1991). All these are necessary in JETS Club activities for purposes of enhancing participation of female pupils.

School administrators should be encouraged to provide support and guidance to female pupils in JETS Club in order to encourage them as well as to minimise difficulties they encounter as club members. All teachers involved in JETS activities must be pro-active in seeking for support from the school instead of waiting for support to come on a silver plate, in view of the demand for attention from other sections of the school. Soliciting for support for JETS Clubs from school administrators could be done during head teachers' meetings held in all educational regions of Zambia. This could be done by Science and Mathematics Standards officers for each region.

6.2.5 Implication related to shortage of materials for projects

The issue of lack of materials for projects came out strongly as one of the challenges experienced by female pupils in JETS Club. The view of the most of the female pupils was that they could only use standard commercial chemicals, apparatus and equipment to work on their projects. However, this is not the case, because pupils are allowed to use whatever is available in the environment including materials such as tomato, plastic bottles which some people consider as less useful for purposes of coming up with a new product. The implication of this is that female pupils in JETS Club should be encouraged to use locally available materials and in some cases, materials other people think are of no use any more. Through creativeness some high quality new product can emerge. It is said that the use of indigenous materials is more motivating to pupils because they are connected to their daily life (Baker, 1998).

6.2.6 Implications related to linking JETS activities to societal issues

JETS Club activities are not based on any prescribed curriculum, which is examined at the end of a specific period of study. Instead, JETS Club activities are determined by pupils themselves under the guidance of patrons. The JETS Club curriculum could, therefore, be said to be open-ended. JETS Club would, therefore, provide an ideal opportunity to include socio-scientific issues which are considered important for preparation of learners for life in society and be able to address some of the challenges in society, which need scientific know-how (Kyle, 2006) . These socio-scientific issues could cover a cross-section of areas, such as health, under-nourishment, inadequate food, inability to access hygienic water, lack of formal employment, farming, soil degradation, HIV and AIDS, cutting down of trees and conservation (Kyle, 2006; Onwu & Kyle,2011).

These issues are also very important in the Zambian context, and are widespread within Zambia. Environmental issues may also be investigated such as global warming, air, land and water pollution as well as desertification (Mulemwa, 1999a). Another category called 'socio-scientific issues' could be added to traditional JETS Club fair categories, so that these issues are given the attention they deserve at present in Zambia. Extra-curricular activities have been identified as a good means for advancing environmental awareness outside time-tabled lessons (Uamusse, Cossa & Queba,2010), thus, JETS Club members could engage in activities intended to promote environmental awareness in Zambia, in communities, in which their schools are located.

Researchers like Mulemwa (1999a) and Boe (2012) have argued that linking science and technology to society would be the most appropriate way of preparing learners to address issues related to science in future. For example, Mulemwa (1999a) contends that pupils in science clubs should be encouraged to do socio-scientific-based activities, which may bring out the application of science and technology to daily life, as well as provide opportunities to devise and carry out a project that has some link to real life challenges and issues in the community of the pupil. Similarly, Boe (2012) holds the view that it is important to engage pupils in socio-scientific issues because it would enable them to develop the motivation to find new answers to significant problems in society. According to Kyle (2012), inclusion of socio-scientific issues in science education is important if society has to adequately prepare learners to deal with difficult daily issues. These arguments apply equally to the Zambian situation.

It is anticipated that engaging female pupils in socio-scientific issues in JETS Club would enhance their knowledge, ability and attitudes required to come up with pioneering solutions to challenges facing humanity in Zambia, as well as to act responsibly in society and make a contribution to sustainable development. Female JETS members could engage in activities in society that would enable them to use natural resources in a way that could continue supporting generations to come, such as use of wood for cooking in most parts of rural Zambia.

Linking JETS Club activities to social issues such as health, nutrition and environmental concerns may also increase female pupil's interest in the club since female pupils usually would like their scientific understanding to be useful to them and other members of society (Boe, Henriksen, Lyons & Schreiner, 2011). Furthermore, issues relevant to daily life have been found to enhance female pupils' liking of science (Rosser, 1993; Baker & Leary, 2003; Jenkins & Pell, 2006). The implication of this is that there is need to link JETS activities in Zambia to real issues experienced in daily life in order to increase the number of female pupils deciding to join JETS Club as well as making what is done there more relevant to female pupils' daily life in society.

6.2.7 Implications related to teacher education

At present, science and mathematics teacher education programmes at both university and college levels in Zambia, do not include a component specifically intended to prepare trainee teachers to play an effective role in promoting science, mathematics and technology extra-curricular activities among pupils, in particular females, as well as providing guidance and support to pupils engaged in extra-curricular activities. One implication arising from the present study is that there is a need to bring to the attention of trainee teachers in the area of science, mathematics and technology in Zambian teacher education institutions, that participation in JETS Club activities is very beneficial to female pupils. Thus, there is need to provide student teachers during their initial training with knowledge, skills and attitudes necessary to promote participation of pupils, in particular, female pupils in JETS Club activities. Another implication arising from the current study regarding teacher education is that it is necessary for teacher educators to provide student teachers with appropriate knowledge, skills and attitudes required to provide guidance to pupils in JETS Club, in particular females who encounter a lot of discouragement from society when they show interest in science and technology-based activities.

The teacher education curriculum in Zambia should also include aspects related to the importance and organisation of extra-curricular clubs such as JETS to enhance their involvement in these activities in the school. Reading materials should be developed for purposes of helping JETS patrons to perform their roles effectively. In India, for example, manuals have been developed to orient teachers involved in science clubs on building innovative eagerness among pupils (Misra, Bhushan, Upadhyay, 2013). Continuing professional development activities for serving teachers in Zambia meant to improve their performance as patrons should be embarked on. Bouffard and Little (2004) assert that continuing professional development for teachers involved in after-school activities can have a positive effect on their understanding of issues and in the running of the programme. From what participants shared regarding challenges they encounter in JETS and why some female pupils avoided joining JETS Club, there are issues related to the running of JETS Club which need to be addressed. Preparation of teachers for JETS Club patron-ship during both initial training and post-initial training should involve enhancing their understanding of socio-scientific issues that would enable them to provide adequate guidance to pupils in JETS Club. The training should also equip them with knowledge, values and attitudes as well as practical skills concerning science education for sustainable development, to enable them guide pupils on issues concerning sustainable development, which is an issue of concern worldwide. Contributions of patrons and other people involved in science and technology-based clubs in Zambian schools would also need to be recognised for the time they put in. School administrators should also support their work so as to motivate them.

6.3 Limitations of the Study and Challenges Encountered

It is important to cite limitations of the study in a report (Creswell, 2003). The current study had some limitations which need to be acknowledged. The first limitation relates to the composition of group interview participants. Ideally, group interview participants should have been homogeneous in terms of sex, educational level and age for maximum participation in terms of responding to questions. In the current study, while all group interview participants were of the same sex (i.e. female), uniformity of group interview participants in terms of age and educational background was not possible to achieve because of the nature of the composition of JETS Club membership. Members were drawn from different grades in the school. Furthermore, dividing the 12 female pupils at each school to create homogeneous groups would have increased the amount of time spent interviewing the various sub-groups formed to create homogeneity in group interview participants. This was not possible to implement because of other activities participants were engaged in, in the school, apart from JETS Club activities. However, during group interview sessions, whose purpose was mainly to understand factors which might have influenced female pupils to join JETS Club, participants were told to forget differences among themselves and to share their views, opinions and experiences freely regarding the subject at hand.

The issue of collection of data using group interviews or one-to-one interviews is worth considering. If the interviews were conducted individually, with female pupils, instead of in groups, the findings might have been slightly different from what has come out. This is because some female pupils might have felt much more free to express their views/experiences in a one-to-one situation with the researcher. They might not have said all they wanted to say in the presence of other participants. However, it is also possible if interviews were done individually, some participants might not have been very free to share information in the manner they did when they were interviewed in a group. It is also possible that they might have remembered certain issues they shared in the group interview session, because of the fact that they said what they said, because of what they heard others say.

The second limitation relates to the personality or identity of the interviewer. Ideally, group interviews involving female pupils should be conducted by a female person, familiar to the girls (e.g. coming from within the school) and perhaps closer to their age. In the current study, the interviews were conducted by the researcher, a male, not familiar to female pupils, and elderly. This may have affected female pupils in terms of how much they were willing to share with the researcher. It has been observed that responses by interviewees can be affected by the characteristics of the interviewer (Denscombe, 2007). However, although the researcher was aware that there could be a demerit in himself moderating the group interviews involving female pupils, he decided to moderate the interviews because, doing so would enable him to understand better female pupils' submissions on who made them decide to join JETS Club. It would also enable the researcher to probe participants in cases where more information would be required. To minimise differences between the researcher and female pupils, the researcher told them about himself (i.e. his background and what he was doing) before the sessions and encouraged them to feel very free to express their views, opinions and experiences since he wanted to learn from them.

The third limitation relates to the context in which the study was conducted. The study was conducted in schools in Lusaka region which, is pre-dominantly urban. The findings may therefore not be the same in schools in other regions, which are pre-dominantly rural. To minimise this limitation, the researcher made sure that the schools which participated in the study in Lusaka had different characteristics (i. e. mission school, girls schools only, mixed sex schools, boarding and day schools), which are found in other regions too. Furthermore, the main purpose was to understand the issues of interest and not to generalise the findings.

The fourth limitation concerns the language used for interviews. Interviews were held in English language, which is not the mother tongue for both the researcher (the interviewer) and the female pupils who were being interviewed. This might have been a problem for some participants who did not know English much, in understanding the question and expressing clearly their views. To take care of possible language problems for some participants, participants were encouraged to ask questions when they were not clear, and the researcher made effort to use simple English terms when asking a question or probing for more information. Furthermore, participants were at high school level, thus not many of them had serious problems understanding English since it is the official medium of instruction starting from grade 5.

The fifth limitation of the current study was in connection with availability of appropriate and most recent literature. The study was conducted here mainly in an environment where appropriate and latest literature was difficult to access. Internet connectivity was also not reliable. In a number of cases, it would be off and when available, it took long to down-load a document. It was therefore difficult to get latest literature. To minimise this drawback, serious effort was made to search the net during the weekend when connectivity was available, and also to use appropriate literature the researcher came across during the period he worked on the study. The researcher also had the opportunity during the course of the study, to use the library for a few days, at Hiroshima University in Japan, KwaZulu-Natal University in South Africa and University of Oslo in Norway.

The sixth limitation relates to the information concerning why the majority of female pupils were not members of JETS Club. This information was obtained from female pupils in JETS Club who participated in the current study. It is based on their interactions with female pupils who did not want to join JETS Club. Therefore, it is possible that some of the information provided by these participants may not be accurate or might be biased. However, some of the information provided was in agreement with what has been documented on STEM activities and girls.

One of the challenges which the researcher encountered while undertaking this study, is that he was doing it while working on full-time basis and heading The Advisory Unit for Colleges of Education, one of the busiest departments in the School of Education of the University of Zambia. This department was a link for the University to Colleges of Education scattered throughout the country. The same department also linked the colleges to the university. Furthermore, during the time the researcher was pursuing this study, he was a mentor to three Masters students, who were pursuing their studies at the University of Zambia under the support of Project SUSTAIN. This also took some of his time. However, it was gratifying that the students completed their studies on time and some are now working as part-time lecturers at the University of Zambia, while one female is managing education at district level. Since this study was being done under distance education mode, the researcher did not have the opportunity to meet his supervisors so often in comparison to students on full-time basis. However, some opportunities were made by Project SUSTAIN to meet them at their respective universities. Literature was also a big challenge, more especially literature on feminist theories which is not very common in Zambia. Some of the literature which we should have got under the project did not come through. Sometimes things were difficult and researcher felt like dropping. However, encouragement from the supervisors and some of the statements (on resilience and determination) from the girls he was studying kept him floating, and hoping to swim across the river to the shore.

6.4 Suggestions for future research

This study has generated a number of questions and issues which need to be further investigated. Some of the areas requiring further research are as follows: The current study has revealed that some of the brothers of female pupils who decided to join JETS Club had negative attitudes towards their sisters' decision to join JETS Club. Why should this be the case? Further research, is therefore, required to establish reasons for such negative attitudes . This study has also suggested that the JETS Club was perceived to be a club for boys only. However, some of the boys did not join the club. It would ,therefore, be necessary to find out why they did not join JETS Club when some female pupils did join. This is because the general thinking in Zambia is that male pupils are more pro-science and technology-related activities than female pupils. However, the opposite is the case for some male pupils.

The current study has also revealed that some JETS Club patrons did not provide adequate guidance to pupils in JETS Club. Why should this be the case? Therefore, further research is needed to investigate why this was the case when they were expected to provide guidance to pupils. This is important in order to understand reasons behind this and take corrective measures. Another issue relates to the location of the current study. Since the current study was done in Lusaka province, which is pre-dominantly urban, it is not clear whether or not the findings generated by this study could be the same elsewhere, particularly in rural areas of Zambia. Therefore, future studies on the same topic are recommended in schools in rural provinces of Zambia, to establish whether or not there are variations on influences to join JETS Club by female pupils.

This study only involved female pupils in JETS Club. It is not clear what influenced male pupils to join JETS Club. Thus, further work is required to find out what influences male pupils to decide to join JETS Club. Furthermore, there is a large number of female pupils who avoid to join JETS Club. It is not known why this is the case. Thus, research is required in this area to understand reasons behind their avoidance of this club. It would also be useful to find out if the skills pupils have acquired from participating in JETS activities are transferred to their daily lives in the Zambian society. It would also be good to do a follow-up study of female pupils who were in JETS Club when they were at secondary to find out what they were doing currently. Another issue that has not been addressed by the current study relates to female pupils dropping out of JETS Club. This aspect was not considered in the current because the study focused on female pupils still in JETS Club. Therefore, another study to investigate the number of female pupils dropping out of JETS Club and why they drop out is required.

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APPENDICES

Appendix A: Demographic characteristics of pupil participants

Educational level

Table 1. shows the educational level distribution of female pupils who participated in the study.

Table 1: Educational level of participants

Grade	**No. of participants**	**Percentage**
10	13	27%
11	12	25%
12	23	48%
Total	**48**	**100%**

As Table 1 shows, the majority of participants were in Grade 12 followed by those in Grade 10.

Age

Table 2 shows the age distribution of participants.

Table 2: Age distribution of participants (female pupils)

Age	**No. of participants**	**Percentage**
14 years	1	2%
15 years	13	27%
16 years	8	17%
17 years	15	31%
18 years	9	19%
19 years	1	2%
20 years	1	2%
Total	**48**	**100%**

As can be seen in Table 2, most of the participants were 17 years old followed by those who were 15 years old.

Birth order

Birth order is used here to mean their position in the family birth rank such as first born, second born. Table 3 shows the birth order distribution of participants.

Table 3: Birth order distribution of participants (Female pupils)

Birth order	**No. of participants**	**Percentage**
Only child	01	2%
1st born	16	34%
2nd born	13	27%
3rd born	07	15%
4th born	03	6%
5th born	04	8%
6th born	01	2%
Last born	03	6%
Total	**48**	**100%**

As can be seen in Table 3 , the largest number of participants were first born children followed by second born children. Literature on first born children identifies a number of personality traits associated with this birth order. They are said to be aggressive or assertive, confident and score high on tests of intelligence (high achievers in school) than those born later. They are also reported to possess a competitive spirit, have greater desire to achieve school success , determination to accomplish their goals, an ambition and drive which may not exist in other children born later (Surfnet Parents, 2011). Literature also suggests that second borns (who were the second largest group of participants in the study) may also have some of the personality traits cited above, if there is a wide age difference between the first born (Surfnet Parents, 2004-2012).

Most interesting subjects

Table 4 shows the distribution of responses from participants concerning their subjects of interest or subjects they found most interesting to learn.

Table 4: Subjects perceived to be most interesting by female pupils

Category of subjects	No. of participants	Percentage
Arts subjects	9	19%
Mathematics	11	23%
Science subjects	28	58%
Total	**48**	**100%**

The distribution of responses in Table 4 shows that close to 60% of participants preferred science subjects such as biology, chemistry etc. while a small number (less than 20%) liked arts subjects such as English, commerce and history.

Future career preference

Table 5 shows the distribution of responses by participants concerning their preferred future career.

Table 5: Future career preferences of participants (female pupils)

Preferred career	No. of participants	Percentage
Natural sciences based	35	73%
Social sciences based	9	19%
No response	4	8%
Total	**48**	**I00%**

It is apparent from Table 5 that slightly above 70% of participants had science based future career preference while less than 10% of participants did not respond suggesting that they had not decided on the type of career to pursue.

Regarding whether or not they had close relatives who, during their time at secondary or high school were JETS Club members, participants respondent as shown in table 6.

Table 6: Female pupils who had relatives who were once JETS Club members

Responses	No. of participants	Percentage
Had relatives who were once in JETS Club	23	48%
Had no relative who were once in JETS	14	29%
No response	11	23%
Total	**48**	**100%**

The distribution of responses by participants in table 6 shows that close to 50% of participants had relatives who were in JETS Club when they were at secondary or high school levels while 23% of the participants did not provide information suggesting that they may not had information on this aspect.

Conclusion: From the information given above, it could be deduced that most of the participants were in grade 12, were 17 years old and were first born. Furthermore, most found science subjects interesting to learn, their future career preferences were science based and had relatives who were once JETS Club members when they were at secondary school.

Appendix B Self-completion questionnaire for collecting background data from female pupils

Introduction

Thank you for agreeing to participate in this study. I am requesting for background information about yourself. Below are questions to guide you in this process. You may choose to answer all questions or to ignore those you may not feel comfortable with. Write your responses in the spaces provided.

1. In which year and month were you born?...
2. What is your birth order (i.e. 1st born, 2nd born, 3rd born etc)..
3. In what grade (10, 11 or 12) are you?...
4. What job does your father do?..
5. What job does your mother do?...
6. Name two subjects you find interesting to learn ....
7. What subjects (2 only) do you want to continue studying after you complete grade12?...
8. Name members of your family or close relatives who were members of JETS Club when they were at secondary school or high school..
9. What career or job would you like to pursue after completing Grade 12?..........................

Thank you for responding to these questions.

Appendix C Group interview guide for collecting data from female pupils

1. Tell me how you came to know about JETS Club.

2. Tell me what made you decide to participate in JETS Club activities.

3. How did people react towards your decision to join and participate in JETS Club activities?
4. Tell how you have benefitted as a result of your participation in JETS Club activities.

5. Tell me challenges you have experienced as a result of your participation in JETS Club.

6. In your view, that could be the reasons why some of the female pupils avoid joining JETS Club?

Appendix D **Permission from Catholic Secretariat to conduct research at a catholic school in Lusaka Region**

EDUCATION SECRETARY
18 DEC 2012
P.O. Box 31965
LUSAKA
ZAMBIA EPISCOPAL CONFERENCE

21 July 2009

The Head

P O Box 30934
LUSAKA

Dear Sister

RE: **MR CHRISTOPHER HAAMBOKOMA**

Mr. Christopher Haambokoma is a Lecturer at the University of Zambia in Science Education. He is conducting a research on what attracts some female pupils to join JETS Club. With the purpose of generating information which could be used to encourage more girls to join JETS, he came to this office to seek permission to interview some pupils.

Kindly assist him in any possible way.

Yours sincerely

EDNA M CHOONGO (MS)
AG. NATIONAL EDUCATION SECRETARY

Appendix E **Permission from the Provincial Officer to conduct research in government schools in Lusaka Region**

All communications should be addressed to
the Provincial Educational Officer
Telephone: 250655

In reply please quote:

No. ………………

REPUBLIC OF ZAMBIA

MINISTRY OF EDUCATION

PROVINCIAL EDUCATION OFFICE
LUSAKA REGIONAL HEADQUARTERS
Private Bag RW 21E
LUSAKA

PEO/LR/101/5/5

19th July, 2010

The Headteacher
……………………..
……………………..

RE: STUDY ON FEMALE PARTICIPATION IN JETS

I have written to introduce Mr. Hambookoma, as a senior lecturer in the department of science education at the University of Zambia. Mr. Hambokooma is conducting a study on the level of female participation in Junior Engineers, Technicians and Scientists (JETS) clubs in our schools. Kindly assist him with the information as he gathers data for the study.

N.H Mwanapabu
A/PRINCIPAL EDUCATION STANDARDS OFFICER
FOR/ PROVINCIAL EDUCATION OFFICER
LUSAKA PROVINCE

Appendix F Consent form for School Head teacher

Introduction

I am a lecturer in science education at University of Zambia. I am conducting a study for purposes of understanding the involvement of female pupils in the Junior Engineer, Technicians and Scientist (JETS) Club in selected high schools in Zambia. As school which has female pupils in JETS Club, I have picked your school to participate in this study. Therefore, I am requesting your school to help with data collection by allowing pupils to take part in group interviews.

Procedures

There will be one or two group interviews session, each of them lasting for about two and half hours. Each group interview session will be based on questions about their involvement in JETS Club. With your permission, the sessions will be recorded on audio tape and video-tape which will be transcribed. We will also be writing notes during the sessions.

Benefits

You will not benefit directly from taking part in the study. However, this study will help us to understand the involvement of female pupils in JETS Club and how we can boost participation of female pupils in JETS Club activities. Refreshments and pens will be given to participants at the end of the interview session.

Discomforts

I do not expect much discomfort from taking part in the group interview. However, participants may find it tiring to sit for too long. It is expected that none of the questions to be asked should make them uncomfortable.

Confidentiality

The name of the school, pupils and those of any person they will mention during the interview will be published in any report. Instead, false names will be used. Furthermore, all recorded information and transcripts will be securely stored in my office and will be destroyed after all data has been analyzed.

Right to refuse or withdraw

The school's participation in this study is completely voluntary. If you decide to drop out or refuse to take part in the study, there will be no penalty to the school.

CONSENT

I have read this consent form and I have been given chance to ask questions. All my questions have been answered to my satisfaction. I have been requested that my school takes part in the study and I have given free consent by signing this form. My consent for my school to participate in the study is voluntary and I may withdraw the school from the study at any time if need be. I am also aware that the information participants in this school will provide, will be treated in confidence and the school as well as participants in the school will not be personally identified.

I also understand that the group interviews will be audio-taped and video-taped. My initials below certify that I agree to have the group interview audio-taped as well as video-taped.

…….. I agree to have the group interview audio-taped.

……………………

INITIALS

……..I do not agree to have group interview (s) audio-taped

…………………….

INITIALS

……...I agree to have group interview (s) video-taped

……………………..

INITIALS

………I do not agree to have group interview (s) video-taped

…………………….

INITIALS

…………………………………………………………………

Name of Head teacher

…………………………………………………………………

Signature of Head teacher

I acknowledge that I have witnessed the head teacher sign this consent form

…………………………………………………	……………………….
Name of Witness	Organization
…………………………………………………	……………………….
Signature of the Witness	Date

Appendix G Consent form for Female pupil participants

Introduction

I am a lecturer in science education at University of Zambia. I am conducting a study for purposes of understanding the involvement of female pupils in the Junior Engineer, Technicians and Scientist (JETS) Club in selected high schools in Zambia. As someone in JETS Club, you have been picked to participate in this study. Therefore, I am requesting you to help with data collection by participating in a group interview.

Procedures

The group interview will last for about two and half hours. The interview session will be based on questions about your involvement in JETS Club. With your permission, the sessions will be recorded on audio tape and video-tape which will be transcribed. We will also be writing notes during the sessions. Before participating in group interview session, I will request you to provide background information about yourself.

Benefits

You will not benefit directly from taking part in the study. However, this study will help us to understand the involvement of female pupils in JETS Club and how we can boost participation of female pupils in JETS Club activities. Refreshments and pens will be given to you at the end of the interview session as a way of appreciating your participation in this activity.

Discomforts

I do not expect much discomfort from taking part in the group interview. However, you may find it tiring to sit for too long. It is expected that none of the questions to be asked should make you uncomfortable.

Confidentiality

Your actual name or the name of any person you might mention during the interview will not be published in any report. Instead, false names will be used. Furthermore, all recorded information and transcripts will be securely stored in my office and will be destroyed after all data has been analyzed.

Right to refuse or withdraw

Your participation in this study is completely voluntary. If you decide to drop out or refuse to take part in the study, there will be no penalty to you.

CONSENT

I have read this consent form and I have been given chance to ask questions. All my questions have been answered to my satisfaction. I have been requested to take part in the study and I have given free consent by signing this form. My consent to participate in the study is voluntary and I may withdraw from the study at any time if need be. I am also aware that the information i will provide, will be treated in confidence and i will not be personally identified.

I also understand that the group interviews will be audio-taped and video-taped. My initials below certify that I agree to have the group interview audio-taped as well as video-taped.

…….. I agree to have the group interview audio-taped.

……………………
INITIALS

……..I do not agree to have group interview (s) audio-taped

…………………….
INITIALS

……...I agree to have group interview (s) video-taped

……………………..
INITIALS

………I do not agree to have group interview (s) video-taped

…………………….
INITIALS

…………………………………………………………………
Name of participant

…………………………………………………………………
Signature of participant

I acknowledge that I have witnessed the participant sign this consent form

…………………………………………………… ……………………….
Name of Witness Organization

…………………………………………………… ……………………….
Signature of the Witness Date

Appendix H Interview guide for teachers

1. **What do you think makes some female pupils decide to join or to participate in JETS Club activities?**

2. **What do your think are the benefits female pupils derive as a result of participating in JETS Club activities?**

3. **In your view, what challenges do female pupils encounter as a result of participating in JETS Club activities?**

Appendix I: Data from female pupils and teachers not included in the findings chapter

Personal influences

I was influenced by my thinking that JETS is not for boys alone. It is for everyone including girls. So I decided to join JETS **(Agatha, Duiker High School).**

I wanted to prove to the world that what a man can do, a woman can also do. **(Lillian, Eland High school)**.

I was not good in Mathematics and Science. So the boys used to tease us saying "the girls at this school do not know Mathematics and they are poor in science". Because of this, I said to myself, "if the boys can do it , I can also do it". I started showing interest in Mathematics and Science and I joined JETS **(Cynthia, Eland High School).**

The other reason for joining JETS Club is that in most families, the first born is a boy and he is usually highly regarded. Since I am the first born and I am a girl, I wanted to show that I can also participate in JETS as boys do and even be better than boys **(Lucia, Antelope High School).**

Some girls are focused on doing activities people think are for boys **(Female, Science Lecturer).**
I wanted to make a better project than my [male] cousin did. I wanted to prove to him that it is not only boys who do better things. I can also do it **(Cynthia, Eland High School).**

During my days in the primary [school], in my class there were mostly boys and they would say "she is just a girl. she won't beat us." There was a specific guy 'Isaac'. He would always make fun of me because he was always at the top of the class. I one day confronted him and told him. 'I will beat you in the final exam.' I joined JETS Club and put in my best and I managed to keep my promise I was the highest. Since that time, I have always wanted to prove to the boys my capability as a girl by being in JETS club that being a girl doesn't mean that you cannot be intelligent because intelligence is what you put in yourself, to build it. So as a girl, if you put in everything, you can do it **(Agnes, Buffalo Secondary School).**

When I was in Grade 11 last year, I heard about people who were doing projects in JETS Club and that these projects can help one get [a] scholarship. So I was like " okay, I think it [JETS] is the best club for me." So I joined **(Celina, Buffalo Secondary School).**

Sponsorship for further studies given to the best pupil in JETS attracts them into JETS **(Female, Standard Officer for Science)**

My ambition is to become a doctor. So I saw that if I joined JETS club, I might get more information about the sciences and achieve my ambition of becoming a doctor **(Hellen, Duiker High School).**

I said it in my family , "if there is no one who has ever taken up medicine and specifically being a surgeon, I would take it up and I would be that surgeon" and I thought that by joining JETS club, I would achieve what I wanted to achieve **(Idah, Duiker High School).**

I joined JETS Club because I wanted to fulfill my career plans of becoming a pilot. People say that it is difficult to become a pilot. It needs people who are intelligent. Therefore, I thought that JETS would help me understand technology better **(Prisca, antelope High School).**

When I grow up, I want to be a doctor. Because of my career plans, I thought that joining JETS can help me a lot to becoming what I want to be because I will be dealing with sciences required to pursue my career. Hence, I joined JETS **(Harriet, Antelope High School).**

I am aiming to be a neuro-surgeon in future. So in order for me to achieve that, I have to be good in sciences. Thus, in order for me to learn a lot about sciences, I had to join JETS because in JETS, a lot of things about science are taught **(Lucia, Antelope High School).**

I decided to join JETS Club because my first career option is to be a surgeon. I think that JETS can get me to that dream of being a surgeon because in JETS we engage in projects which help one think faster and accurately at the same time **(Agatha, Duiker High School).**

They [female pupils] think that it is a stepping stone into a career of their desire **(Male, Standards Officer for science).**

When I heard about JETS and attended the meeting, I thought it would be beneficial if I became a member because, apart from what I learnt in class I could learn more about sciences and it would help me understand sciences more **(Eunice, Antelope High School).**

For me, the sciences are my favorite subjects. So I decided to join JETS to help me learn more about science and what it deals with **(Harriet, Antelope High School).**

I have been a member [of JETS Club] since grade 10, I am in grade 12 now. The desire of having knowledge about things that I do not know about, which can improve my life, specifically in sciences made me join JETS Club and stay on **(Celina, Buffalo Secondary School).**

My desire to learn science also influenced me to choose JETS club. Myself, I am a person who loves learning new things. So I wanted to join this club so that I can have many ideas involving my science academic work **(Hellen, Duiker High School).**

I joined JETS to learn more because as you learn more, you became experienced **(Doreen, Duiker High School).**

I joined JETS so that I could learn things that were advanced so that I would be ready when it comes to learning in class **(Lucia, Antelope High School)**.

They [female pupils] have desire to be exposed. This because pupils in JETS Club interact with other people e.g. professors during national JETS fair. JETS Club members also visit other places **(Female, Standards Officer).**

For me, I joined the club to meet various people and to widen my knowledge **(Daisy, Buffalo Secondary School).**

When I was coming to this school, a lot of my friends were telling me that pure sciences are hard. I like sciences so much that I did not want to start failing in them at this school. When I found out that in the JETS club members learn more about sciences, I decided to join because I was of the view that if I would not understand a particular topic when it is taught in class, when the same topic is raised at a JETS meeting I would understand. So I joined JETS so that I could do well in sciences **(Nancy, Antelope High School).**

When I came to this school in Grade 10, People were saying that biology and chemistry are easy sciences but a physics was very difficult subject. Not everything was taught in class and the physics syllabus was usually not completed at this school. But in JETS club, they teach things which are not taught in class. Since physics is my favorite subject, I would like to do well in it and since people say physics is a challenge, I like to challenge myself that since physics is the subject people fear, I should strive to come out best in physics. So I joined JETS to help me do well in physics **(Dorothy, Antelope High School).**

I joined JETS because my science grades were not good . However, since I joined JETS, my science grades have improved. So because of my grades improving, I have been determined to stay in JETS Club **(Ellen, Duiker High School).**

I was not good in sciences and mathematics in class. So I felt that maybe if I joined JETS, I can improve **(Grenda, Eland High School).**

When I came to this school in Grade 10, I never used to perform well in class. So I decided to join JETS Club and I am improving in my performance as a result of things I learn from other people and my friends teaching me (**Getrude, Duiker High School).**

I said it in my family, "if there is no one who has ever gotten six points (in the Grade 12 final examination, I am going to get that six points and I thought that by joining JETS club, I would achieve what I wanted to achieve **(Idah, Duiker High School).**

They [female pupils] have a desire to score better or to have better results in science and mathematics because JETS Club makes them to study extra harder **(Male, JETS Club Patron).**

Interest in science activities

What influenced me [join JETS] was that I love science. I have always loved science **(Agatha, Duiker High School).**

I was inspired to join JETS club because of my love for sciences. I have always loved science even way back at Primary school. The reason why I love science is because of my love for nature, I love things that have to do with plants and animals like my colleague Doreen said. It is just amazing to see how things work and you see how God created our beautiful environment. So that love for nature also inspired me to learn more about sciences and that is how I came to join JETS **(Juliet, Duiker High School).**

They usually have JETS meeting during the week. When I attended one of these meetings, I found that the topic of discussion was interesting. Thus, I decided to join JETS Club (**Nancy, Antelope High School).**

It's all about experiments. I love experiments. I remember when I was in the same class with Bertha, we did an experiment on my finger. We were trying to find out something. So I believe that bertha and I have something in common. We both like experimenting **(Sandra, Eland High School).**

When I came at this school, I attended a JETS fair and the projects that were displayed in different categories were very interesting. I got inspired and I said "if they can make it, then I can also do it". I then decided to join the Club **(Hilda, Eland High School).**

I was also encouraged to join JETS Club by the many things that they do in JETS Club like researching **(Lillian, Eland High School).**

I did not get inspired by anyone else It is my own inspiration because I am very interested in discovering new things. I would like to discover new things through experiments. So I thought JETS would be an opportunity to discover new things **(Natasha, Duiker High School).**

I saw that most of the JETS Club members are intelligent and that most of them get awards like every term. So I wanted to be like them. I wanted to join them "if you can't beat them, you join them" **(Getrude, Duiker High School).**

Family influences

With regard to joining JETS club, my brother told me to say it won't be right for me to stand up and say we deserve equal rights and stuff like that with boys. I have to fight for it and show that I am as good as boys. So I decided to join JETS club because of what he said **(Agatha, Duiker High School).**

I also wanted to prove to my brother that I can do better than him **(Felistus, Eland High School).**

Last holiday when I went to my uncle's place, he asked me what I wanted to become when I finish studies. I told him I want to become a chemical engineer. Then he asked me what I was doing in order to achieve that. Since he was also at this school for his high school, he encouraged me to join JETS so that I could learn more about the careers that involved science. I therefore decided to join JETS club **(Ireen, Antelope High School).**

My mother, sisters and brothers motivated me to join. They said that since I wanted to become a chemical engineer, I should get involved in such things [JETS] **(Ireen, Antelope High school).**

My mum is really good at mathematics and my dad trained as an engineer and he loves science. So both thought that I should join JETS because they were of the view that it would help me to be like one of them **(Jane, Buffalo Secondary School).**

What influenced me to join JETS Club is my brother and sister in-law I stay with at home. They told me to join a club where I would l benefit from, a club where I would learn a lot . So I decided to join JETS **(Hilda, Eland High School).**

I was influenced to join JETS by my mother because she told me that I could learn more and that can help me improve in future **(Rachel, Buffalo Secondary School).**

At first in Grade 10, I was not really interested in science and I was not doing well in science and my mother saw this. She asked me if there were science clubs at school and I told her that there was JETS Club. so she told me that joining the JETS Club would be a good idea because in JETS Club, I would learn a lot of things **(Bernadette, Duiker High School).**

For me, my parents are not interested in sciences. They are both journalists. However, when I was a kid I used to say I want to be a doctor. So my mum was like, "You better improve your grades and how can you improve your grades apart from school?" "You better join JETS". This was a rare thing for a parent who is in another career encouraging something to do something which does not involve her career. She was for the idea of JETS and at all cost she would sometimes come and talk to my science teachers on how I would improve my grades and the like. So whenever there was something to do with science on Television, she would make us watch even though it was boring. She would make us watch documentaries in science so as to make us develop interest. As a result I developed interest and joined the JETS club **(Celina, Buffalo High School).**

I came to join JETS through my cousin. My cousin encouraged to join. I was poor in sciences by then and he encouraged me saying that may be if I joined any science club at school, I can improve my performance and my marks in class (**Maureen, Duiker High School).**

My brother also inspired me to join JETS Club. He was the secretary of the JETS Club at his school. He was doing well in sciences and, he would tell me stories about what was happening at the JETS fairs he attended. I got very interested because it sounded exciting since other people used to say that JETS was boring. Since I wanted to do well in science too, I decided to join **(Dorothy, Antelope High School).**

I also used to love experimenting stuff, I would get spirit, lotion and start mixing them saying I am making a chemical and I was telling my uncle about my love for experimenting. So he advised me to joining JETS. That's how when I came here in Grade 10, I was looking for a club where they do the same experimenting stuff and I really never knew what the name was. So I asked my big sister who was at Lembe and she told me the name of the club that was JETS. So I joined **(Sandra, Eland High School).**

I got influenced to join JETS Club by my uncle who liked watching National Geographical Channel. If he is watching and you are making noise, he will tell you that you should at least come up with something not just making noise. So every time he is watching and there is something interesting, he would call us to see. If he is watching a science fair, he would call us to see what people are making. So I decided that one day, I should come up with something . I decided to join JETS **(Bertha, Eland High School).**

My brother likes making things. Sometimes you just find him seated down and he will come up with something which is impossible. He comes up with things that you cannot manage to make. If he explains it to you, it will end up being a very advanced project. So he made me join JETS because I wanted to do a project like the one he was doing **(Isabel, Buffalo High School)**

Peer influence

The first thing which influenced me to become a member of JETS club is a friend. I saw that his performance in class was quite good. My friend was very good in class he used to pass very well in physics, chemistry, biology and even mathematics. I tried to interact with him so that I can get more information or the secret which is making him to perform well. His response was like "there is this club at this school called JETS. So if you join you can also become good in sciences and mathematics". Hence, I decided to join **(Hellen, Duiker High School).**

I was not into things like clubs when I came to this school. I thought that it was a waste of time to belong to a club. I interacted with different people and I tried to join JETS but I stopped. However, my friends Mirriam and Betty kept on encouraging me to be in JETS Club. Because of their encouragement, I attended several JETS Club meetings where I found that we learnt different things and I finally made up my mind to join because I wanted to continue to learn more **(Celina, Buffalo Secondary School).**

Club members' influence

What really inspired me to join JETS club is a boy named Ernest. He was a grade 12 last year and he used to get almost all the awards at school and he used to get the overall award. Adding that he was in JETS and studying, so to me it was a challenge. I tried to say if he can do it then I can do it. So I joined so that I could also perform well as he did and receive an award **(Doreen, Duiker High School).**

One other person who inspired me to join me was a girl who was here last year who won a first prize in JETS and she was given a scholarship to go Canada. So I would also like a scholarship to go to Canada **(Albertina, Eland High School).**

When we came here in Grade 8, we found some pupils being awarded because of being in JETS. The certificates really looked good, I should admit. This made me choose to join JETS Club **(Beatrice, Buffalo Secondary School).**

A friend who was a member of JETS Club used to encourage us about JETS Club and told us what goes on in the club. His performance in assessment tasks was always good. So myself, I also had the same determination so that I can be getting the good results the way he used to do it. Thus, I got the interest of joining this club **(Hellen, Duiker High School).**

The people that were already members of the JETS Club motivated me to join the club. They seemed not to have had problems in their studies. This is because whenever one had a problem to solve, the other members were at hand to help. So I decided to join (**Daisy, Buffalo Secondary School).**

One of my fellow pupils in JETS Club influenced me to join JETS because she did a project and she even got a certificate. So it was encouraging. I also wanted to do one **(Florence, Buffalo Secondary School).**

I had this friend of mine who used to be in JETS Club at Macho Secondary, he did a JETS project about a bridge. If you made anything pass through the bridge, for example a toy car, the bridge would weigh the car. Since I want be a civil engineer, I was amused by his project. It really inspired me and led me to joining JETS club **(Cecilia, Antelope High School).**

Another person who inspired me was Menga from Maro Girls School who did a JETS project on how to know if a person is pregnant using a frog. So when she made the project, I was very inspired and encouraged to join JETS **(Albertina, Eland High School).**

I gained interest this year when my friend was making his project. When he was making the project, I asked him what he was doing. He told me that it was a project for the JETS fair and afterwards, I asked him what JETS was about. He told me that it was about mathematics and science activities. Then I got interested and I joined the club **(Getrude, Duiker High School).**

When I got in Grade 11, JETS Executive members started advertising in classes encouraging us to join the club . I got interested and decided to join **(Natasha, Duiker High School).**

A pupil in JETS club at this school was advertising for a JETS meeting. I decided to attend this meeting. At this meeting, we talked about a plant cell. In the class when the teacher was teaching about the plant cell, I didn't understand. But when my fellow pupil who was in the JETS club explained it to me at this JETS meeting, I understood. He then encouraged me to become a member. So I joined **(Betty, Antelope High School). (appendix)**

I was informed by some friends [in JETS Club] that during JETS meeting, they discuss topics we have not done in class. I found it advantageous to go there so that I could learn the topics in advance. This encouraged me to join JETS Club (**Gloria, Antelope High School).**

Teacher influences

As for me I was forced by our headmistress to join JETS. However, since my dad is a lawyer, he was against me joining JETS. He was like "join debate it's the best". Then I joined debate but then we just used to argue all the time, shouting at each other, always arguing. So our headmistress came to me one day and told me to join JETS. She said "you learn new things in JETS Club not only school things but other things as well." So I was like okay, I am going to try it out. Thus I joined JETS **(Naomi, Buffalo High School).**

My science teacher at Marian Secondary School inspired me to join JETS Club. He was the patron of JETS Club. He picked me and other pupils to participate in a JETS quiz panel and we won. He then told me to continue with JETS so that I could learn more and become better in sciences. So I decided join JETS **(Angela, Antelope High School).**

Some science teachers talked about the importance of JETS Club and how helpful it was in terms of learning and preparation for future life. I thought it would be useful to be in JETS. Thus I decided to join (**Ethel, Eland High School).**

I joined JETS because I was encouraged by my teachers to do so. They told me that JETS is a very good club and if I join it, it could help me a lot in my school work. I decided to join because I wanted to do well in mathematics and science (**Linda, Buffalo Secondary School).**

I came to know about JETS Club when I came to this school. My friend told me that only people who are good in mathematics, biology, physics and chemistry were suppose to be in JETS Club. So since I was not good in mathematics, I said to myself that it was not possible for me to join. Then, I asked my teacher about it, he encouraged to join and told me that it would help me improve in Mathematics. Because of this, I joined **(Lillian, Eland High School).**

Peoples' reaction towards female pupils' decision to join JETS Club

When I told my parents that I had joined JETS club, they were happy because I was the first girl to mention JETS in the house, since the boys are used to doing things like fixing the car **(Betty, Antelope High School).**.

My mum encouraged me. She was like, 'just go for it' because she knew JETS was going to help me with my school work since I have this ambition to be a doctor. So she encouraged me, she was like 'just go for it' and it is going to help you' **(Hillary, Buffalo Secondary School).**

When I told my mother that I joined JETS which is a science club where we learn about biology and chemistry. She said " you have never been doing well in sciences. It is good you have joined JETS club. At least you might improve your grades in sciences. She really encouraged me and I was really happy with her response **(Ellen, Duiker High School).**

My mother was also happy to hear that I joined JETS club because she was also in JETS Club when she was at school **(Maureen, Duiker High School).**

For me my brother was happy with my decision to join JETS Club because he used to like connecting things to do with electricity and when he did that I used to tell him that one day you will burn the house. So he thought that by me joining JETS club, I would understand things like connecting bulbs and repairing stoves **(Gloria, Antelope High school).**

My young brother would come to me and say 'Agnes, I am so proud of you. That is a 12 year old boy coming to you and telling you I am so proud of you. It just makes you feel so good **(Agnes, Buffalo Secondary School).**

As I mentioned earlier my grandmother is the one who encouraged me to join JETS. When I told my grandmother that I was in JETS club, she was happy and she told me it is good to do something that you like and to do something which helps you **(Loveness, Duiker High School).**

My friends in the school were also happy, my friend at home was also happy because she is good in sciences and she told me I can also be good through joining JETS club **(Maureen, Duiker High School).**

Peoples' Negative Reactions towards female pupils' decision to join JETS Club

My brother was like "okay what are you trying to do? Are you trying to live above what you can do?" So I just brushed it off I was like, okay whatever it maybe, and I stayed on in JETS **(Celina, Buffalo Secondary School).**

My brother laughed at me because he thought JETS was only for intelligent people and the only thing you do is sit and learn. He thought I was trying to be a geek by joining JETS club **(Elinah, Buffalo Secondary School).**

My brother told me that when you join JETS club you just waste time because most people who are JETS do not get good marks because they are usually concentrating on things that are higher than their level of understanding **(Idah, Duiker High School).**

When I told my uncle about it [i.e. my decision to join JETS], he did not approve my choice. My uncle is a difficult person. So he still does not believe in me up to now. There was this time when I got 79 percent in mathematics and he still said 'no that's a fail'. He only believes in his daughter and not in his nieces or nephew. The first time I told my uncle, he was like 'I am sure you just sit watching and not doing anything during the JETS meetings **(Sandra, Eland High school).**

Since most of my friends are not in JETS club, they were unhappy. They were even telling me that I was abandoning them because I thought I was too intelligent than them. They discouraged me by telling me that JETS would just be taking up most of my study time and that I would be failing in class. But I told them that no, I want to become a chemical engineer and for me to be what I want to be I just have to take this challenge and be in JETS club, you have to forgive me because I have to leave you for now **(Ireen, Antelope High School).**

Benefits of participating in JETS Club activities

As a result of participating in JETS Club activities, I have been doing well in class. For example, I have been at the top of the class because of the researching for information I have been doing in JETS Club **(Inutu, Eland High School).**
I am doing better in Chemistry because we are taught during JETS Club meetings **(Grace, Buffalo Secondary School).**

Participation in JETS Club activities has helped me to improve my confidence to do certain things such express myself **(Dorcus, Eland High School**).