Addis Ababa University

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Contributing Factors for Female Students' Attrition in Science Education: The Case of Faculty of Science at Addis Ababa University, Ethiopia.

BY: HELEN TESFAYE GEBRU

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Abbreviations

BPR …….....	Business Process Reengineering
BESO……	Basic Education System Overhaul
EHEEQE…….....	Ethiopian Higher Education Entrance Qualification Examinations
FDRE……	Federal Democratic Republic of Ethiopia
FDRGE ……	Federal Democratic Republic Government of Ethiopia
ETP……...	Education and Training Policy
GPA …….....	Grade Point Average
HESO ……..	Higher Education System Overhaul
KTTC…….....	Kotebe Teachers' Training College
MOE …….....	Ministry of Education
TGE……..	Transitional Government of Ethiopia
UNICEF …….....	United Nations International Children's Fund
UNESCO …….	United Nations for Education Science and Cultural Organization
UNECA……	United Nations Economic Commissions for Africa
YWCA……..	Young Women Christian Association

Abstract

The need to be part of the globalized science-lead economy on the one hand and ensure social justice on the other necessitated including half of the human race, women. This requires giving special attention not only on the enrollment of female students in science education but also on their retention. To the dismay of the Faculty of Science at Addis Ababa University, despite deliberate and continuous efforts to enroll female students so far, the number of female who graduate has been negligible for the last five years. Therefore, this study examined different factors for female students' attrition in the faculty. A mixed method of approach was used to gather information on the factors of female students' attrition by employing quantitative and qualitative methods. This study reports on a result of a survey from 89 randomly selected female readmitted students from six departments. It also reports responses of 11 in-depth interviewees who were drop-outs and readmits and one group of focus group discussion. The respondents returned the field questionnaire about their backgrounds, attitude about science education, and factors that contributed for their attrition. Most are found to have negative attitude towards their ability to study and succeed in science fields especially in physics and mathematics. Low pre- university academic preparation was a factor to most of them. Insufficient and irregular academic support session in the faculty and absence of support and interaction between instructors/advisor and students were cited as factors for their attrition by many. Factors related to unfair grading system, or poor teaching quality in the faculty were cited as a factor by few. Most common reasons for their attrition falls under the following classifications: Socio-psychological factors, academic and support related factors and personal factors, including marriage and health issues. This finding agrees with the existing literature. The study has provided recommendations for the faculty improvement. These include providing sufficient and regular support, continuing evaluation of advisors/instructors, providing tutorial class for students with different or insufficient levels of knowledge.

Chapter One
Introduction

1.1 The Background

> "Education is the great engine of personal development. It is through education that the daughter of a peasant can become a doctor, the son of a miner can become the head of the mine and the child of a farm worker can become the President of a great nation." (Nelson Mandela, 2005)

This saying exemplifies that education is the most effective means that any society has to possess for confronting the current and future socio-economic challenges, and indeed to shape our world of tomorrow. Any country's capacity to generate, accumulate, deploy and utilize knowledge, skills and information is critical to its development (UNDP, 2007).

Today, we live in a world where there is a massive shift from industrial to information technology. In an increasingly technologically and scientifically advanced world, education is the key to scientific progress and is crucial to involvement in scientific pursuit. In this new global and knowledge-based economy, science, information and communication technologies are the new tools for development with enormous potential to transform the quality of life of people in the developing world (World Bank, 2008). It is, therefore, unquestionable that higher education for science is a major powerhouse in which development process of our society and our future relies.

This would enquire science educational and training programs that pay special attention to those socio-cultural, economic and political factors that inhibit the full participation of certain sectors of the society, such as women and girls who make up 50% of the world's population (UNESCO, 2009). Thus building human skills through investment in science education is a critical component for knowledge development. This development cannot occur while excluding half of the human race that is the women folk.

There are strong educational and social arguments why under-representation and under-achievement of female students in science education should be addressed. Any properly rounded education should include science and all students, both male and female, should

have equal access to the subjects, have equal opportunities to perform well, and should be equally excited by the learning opportunities they are given. These arguments are cogently expressed in the various documents related to the Millennium Development Goals and the UNICEF promoted Girls Education Initiative (UNICEF, 2005).

Researches, however, indicate that there is gender attrition disparity in science education. For example Elliott et al, (2000) show "There is high attrition rate for women in science education due to socio-psychological factors" (2000, p. 140).

Various reasons are given for this difference for achievement and retention between male and female students in science education. Some researches attribute the reason to the differential treatment of girls and boys that the teachers make in science related subjects (Bernstein et al, 2001). Woolfolk (2004) stresses that there is a difference in the treatment of male and female in the society and the school community, and that the sex role is one of the first learned behaviors by individuals. In support of this Bernstein et al. (2001) said "Gender difference in achievement motivation emerge early in life, may be because of differences in the ways that boys and girls learn to think of themselves and their performance" (2001, p.380).

According to Slavin (2005) one reason for the high attrition for women is that female students consider the 'hard science' as male domain since the main users of science careers are males. Some researches attribute to interest and self-concept. Studies found that the major reasons for the differences could be traced to the girls' lack of interest in the subjects and lower self-concept in the area (Woolfolk, 2004).

Thus, throughout history women in the world have been ill represented in science education (Leslie & Oaxaca, 2002). Makhubu (2006) citing a study commissioned by the UNECA (2004) which evaluated women in science and technology based training programs and professionals in Kenya, Sierra Leon, and Swaziland. The findings indicated that girls and women are marginally represented in science areas. The same thing is true for Ethiopian women; during the previous regimes science field has been traditionally male dominated area; and women had been marginalized in the area (Eshetu, 2002; Ruth, 2003; Medhin, 2004; Seyoum, 2004). These studies indicate that there is a persistent and serious shortage of female students in science particularly in physics, chemistry, and mathematics. They

highlight the socio-cultural, economic, political factors that perpetuate female underachievement in the areas.

But at present, there are patterns of improvement in the area of educational access though. Ethiopia is introducing a reform to its higher education to be part of the global knowledge economy (TGE, 1994). Hence, following the adoption of the Education and Training Policy, the Ministry of Education has produced a document entitled Higher Education System Overhaul (HESO) in 1993 that outlines a reform for its tertiary education. The reform's objectives are to ensure gender equity, access, accountability, relevance and responsiveness to the demands of the Ethiopian people.

In addition to this the transitional government of Ethiopia launched a national policy for Ethiopian women in 1993 to ensure the equality between women and men; so that women can participate in the political, social and economic life (TGE, 1994). The constitution of the FDRE has also emphasized the need for affirmative action in article 35: 3 (FDRE, 1995). A national strategy was issued in 1993 that helps to narrow the gap and encourage females to take up higher education by taking lower cut-off scores for female (MOE, 1995). To increase the participation of women in different field of study including in the science field, women are also given priorities 20% of the places in different departments have been reserved for female students for each field of study and allowed to enter with lower score than required for male (Beyou, 2003).

However, the current massification campaign is so praiseworthy; recent researches have shown it has failed to ensure both proportional representation and retention of female students in science related fields education in higher education (Medhin, 2004; Tesfaye, 2004). These researches shows that in the last decade Ethiopia has experienced a substantial and problematic increase in the amount of female students attrition in higher education particularly in science education.

The question is if all those female students are becoming fruitful and accomplished their program successful. Hence, this is the background leading to the present study, which initiated the researcher to examine factors which hinder female students' success in science related fields of study.

1.2 Statement of the Problem

The necessity of female students' access and success in science education should be viewed from the perspective of globalized knowledge economy on the one hand and social justice on the other hand.

However, as simple observation and available documents reveal there is unbalanced recruitment and retention of female students in many universities of Ethiopia. This makes it difficult to ascertain female students' role in science-lead knowledge economy.

Situations are different in present times, in most cases, attention has been given to the enrollment of female students to higher education in all fields of study through affirmative action (Tesfaye, 2004). Even if, the goal to improve female students' enrollment and needs no justification, great concern has to be given to the issue of attrition after enrollment. This study contends that the emphasis on increasing female enrolment, but not doing enough to retain them to get through their studies is equal to denying female students access to higher education.

The study of factors for female students' attrition particularly in science education in higher education in Ethiopia is an under-investigated research field. Therefore, the researcher is undertaking this study to explore factors which contribute to female students' attrition in science education.

1.3 Objectives of the Study

1.3. 1 General objective

The main objective of the study is to explore the contributing factors for female student's attrition in science education in the Faculty of Science, Addis Ababa University, Ethiopia.

1.3. 2 Specific objectives

On the basis of the general objective, the specific objectives of this study are:

1. To know the trend of female students' access, success, and attrition in science education
2. To explore female students' attitude towards science education
3. To identify factors for female students' attrition in science education

1.4 Definition of key terms used

Some of the terms used in this study should be understood in the following context.

Attrition: - in this study attrition refers to the overall unintended output of the educational system in the form of dismissal, dropout and enrollment after a certain period of discontinuation.

Attitude: - is the way one thinks and behaves towards a person, thing, event, place, idea or situation.

Gender: - is a social construct which refers to the traits and behaviors that a particular culture judges to be appropriate for men and women; while sex refers to the biological differences (Woolfolk, 2004)

Affirmative Action: - refers to a set of practices undertaken by government agencies to go beyond non discrimination with the goal of activity improving the economic status of women with regard to education.

Sexual Harassment:- consists of verbal or physical conduct of a sexual nature, imposed on the basis of sex… that denies, limits, or provides different … treatment (Fagin, 1998).

1.5 Rationale of the study

The study focused only on attrition of female students in science education. In higher education attrition of female students is higher compared to that of male students. This could be taken as the core rationale to investigate and forward points on female students' retention.

Moreover, a lot has been done regarding attrition of female students. The majority of the studies give emphasis to the attrition of female students in higher education. Contributing factors for attrition of female students in science education particularly in higher institutions has not yet been touched well, particularly in developing countries like Ethiopia. Without investigating contributing factors for female students' attrition in science education it is hard to implement various educational interventions to increase retention of female students in this field of study. This situation has prompted concern and interest in investigating and understanding the factors behind and the possible solutions to the gender disparities in attrition.

Proximity of the area was still another reason for the selection of the study.

1.6 Need and significance of the study of the study

From my experience in my internship at the Faculty of Science for the 'Practicum in Gender Studies Course', I came to observe attrition is prevalent among the female students despite their very less number in enrollment. I heard stories that many female students have been receiving academic dismissals and several left the faculty voluntarily after they were assigned to Physics or Mathematics Department by the Registrar Office in Faculty of Science against their interest. The statistical data of the Registrar Office of the Faculty of Science also reveals the gender gap in enrollment and retention (Please see Table 1 and Table 2), which initiated the researcher to undertake this research.

As the education and training of scientists becomes more and more crucial to modern society's wellbeing, we are ever less able to tolerate the loss of interested female students from the field. The struggle to increase female participation in this important field will benefit from this research that identifies factors to female students' attrition in science education.

The researcher believes that this research serves as a springboard to embark on further research on gender difference in science achievement in other of similar settings. It may serve as a reference and as a data base for future comparison in this area of educational research.

This study helps the faculty staff instructors and other stakeholders evaluate their methods with regard to success with female students in science education. The paper concludes with a discussion of the significance and implications for curriculum reforming, policymaking, and future research for advocating gender equity in science education.

1.7 Ethical Considerations

Research on the issue of studying students' factors to attrition may interfere into their private life. Making ethical considerations is imperative due to sensitive nature of the topic. The respondents for this study are made fully aware of the purpose of the research and the extent of confidentiality of their responses. Only willing participants were included in the study. To this effect, codes instead of names are used to identify them in the paper (Please see Appendix D).

1.8 Delimitation of the study

The study is confined only to college female science students. High school females were not included due to the constraints though scholars in the area believe (Meinholdt & Murray, 1999) that the impact of gender role stereotyping on female students achievement in science education is high at college than at earlier ages.

The study is delimited to government institution, Faculty of Science at Addis Ababa University, for the for the purpose of uniformity and manageability.

1.9 Limitations of the study

The principal limitation of this study revolved only in the context of the faculty of science, and therefore cannot provide conclusive results related to university-wide trends.

The research would have been more comprehensive and conclusive if it has been carried out from college female science students at a national level. However, it was limited to female students at the Faculty of Science in Addis Ababa University due to many factors such as financial and the constraints to undertake the research.

Furthermore, the data provided are only a ‘snapshot’ of second semester of the academic year, 2010.

Chapter Two

Review of Literature

2.1 Overview of the Ethiopian Education and Women's Participation

Modern education in Ethiopia is a recent phenomenon. A proclamation encouraging the people to give greater emphasis for modern education was issued in 1898, which laid down the foundation for the spread of modern education in the country (Habtamu, 2003 in Teffera & Altbach, 2006). In 1908 the opening of Menelik II School remarked the beginning of modern education. Soon after, Menelik II opened three more schools one each in Harar, Dessie and Ankober. Following his examples, the regional governors also opened schools in Yirgalem, Gore and Harar. Merely 100 students were selected from expatriates to enroll in this school. Children of the farmers and poor nations and nationalities did not have the opportunity for education. Despite some improvements of educational aspects in both Menelik II and Hail Selassie I regimes, the excluded had little or no access for education.

In the 1960s, tertiary education continued to spread out with the opening of several junior colleges outside the capital, Addis Ababa. These included the College of Agriculture and Mechanization at Alemya, Ambo, and Jimma; the College of Public Health at Gonder, and the Polytechnic Institute at Bahirdar. Subsequently, the Institute of Building Technology, College of Engineering, Kotebe College of Teacher Education and the Theology College of Holy Trinity were established in the capital (Habtamu, 2003 in Teffera & Altbach, 2006). Of Technology Institute, the Jimma Institute of Health Sciences, as well as the expansion of the graduate programs that were launched in 1978 at Addis Ababa University. In the 1982/83 academic year the overall enrolment reached 246, of which only 15 were females (Habtamu, 2004). Since then, graduate courses have been offered in several areas, including engineering, natural science, agriculture, social sciences and medicine. However, unlike in the 1960s and 70s when there was a lot of optimism and hope for development attached to the role of higher education in most African countries, including Ethiopia, the 1980s saw little progress owing to lack of harmony between communist dictatorial governments and universities, exacerbated by serious financial and resource constraints due to budget cuts and subsequent human capital flight to the West. Towards the end of the 20th century significant changes in attitude towards higher education began to emerge both nationally and

internationally. In the main, the reversal in the policies of international financial institutions such as the World Bank with respect to the investment of African states in higher education, coupled with the changing scenario in higher education in response to the pressure of globalization, necessitated the expansion of higher education (Habtamu, 2003 in Teffera & Altbach, 2006).

At any rate, in the 1980s the lack of attention to higher education in Ethiopia, for the most part, victimized women and other disadvantaged segments of society (Habtamu, 2004). The consequences were inter alia: inadequate numbers of qualified people to satisfy the country's human resource needs, low level of knowledge production, and disparity in access to and equity in participation in higher education. As a result, the overall access to tertiary education was about 1%, a figure far less than the sub-Saharan African average (World Bank, 2003). Given the initial inequality with respect to access, female enrolment in higher education was by far the lowest with an average share of 12% in mid - 1990s. To redress the disproportionate opportunities disfavoring females in the education sector in general and in higher education in particular, it was necessary to put in place a policy framework that prepares the ground for the subsequent steps in the desired direction.

After the fall of the military regime of Ethiopia in 1991, government policies began to incorporate gender issues in socio-economic and political aspects. Thus, in all sectors of development gender mainstreaming received considerable attention, in recognition of the crucial role of women in poverty reduction and bringing about sustainable development. These positive beginnings were apparently backed by a framework inherent in the Constitution of FDRGE (1995). Accordingly, Article 35, No.3, of the Constitution states:

> *The historical legacy of inequality and discrimination suffered by females in Ethiopia taken into account females, in order to remedy this legacy, are entitled to affirmative measures. The purpose of such measures shall be to provide special attention to females so as to enable them compete and participate on the basis of equality with men in political, social, and economic life as well as in public and private institutions* (1995, p. 93).

Within the constitutional framework the ETP further stipulated the need to address the long-standing inequality and discrimination suffered by the Ethiopian women. "Special attention

will be given to females and to those students who did not get educational opportunities in the preparation, distribution, and use of educational support input" (TGE 1994, Article 3.7.7). Similarly, the Ethiopian Higher Education Proclamation No. 315/2003 (FDRGE 2004) further articulates the need to implement affirmative action for females, students with disabilities and native students of disadvantaged regions:

Therefore, the policy frameworks addressing the issue of gender equity as well as fostering female retention and success in higher education are now in place.

2.2 The Overall Picture of Ethiopian Women in Science Education

There has been significant growth in numbers of women accessing higher education since the masification of 1994s. A report by Eshetu (2002) on a panel discussion organized by Chemical Society of Ethiopia on "Women in Science Education" in April 2002 as cited in Medhin (2004) shows reports that women appeared in social science field of study in greater numbers in all areas of study except for science and engineering, where there were very few women. A Science particularly 'hard science' is still seen by many as a historically male-dominated profession to which women have only relatively recently been admitted**.** Biology is not so male-dominated, but again marked attrition is notable. In examining under-representation, Medhin (2004) patterns of vertical and horizontal segregation are observed: The pattern of attrition (the further one goes up the hierarchy, the fewer the women) persist in all disciplines including engineering and technology, not just Science. This pattern is also seen in developed countries like North America, United Kingdom where there have been programs to encourage girls to go into the sciences for many years thus this is not Ethiopia specific issue (Keller, 2006; Davis, 2001; Brannon, 2002).

Under-representation and under-achievement of women in science fields can be said to result from a number of factors affecting women especially at different levels of schooling (Abebayehu, 1999 cited in Amare, 2005). Social and cultural beliefs about the role of women in society have a powerful influence on determining the social and economic roles played by women in our society, as well as determining the opportunities that women have access to. It is possible to argue that the principal reasons for the low numbers of women and girls in science are the social attitudes about the role of women in society, which still strongly define certain careers as male or female, and particularly define traditionally-male educational

careers as not appropriate for women. Moreover, there are numerous other well-entrenched social attitudes, sayings, proverbs and stories that belittle women's capabilities and these in turn stand as major obstacles to women pursuing areas in science and technology. Proverbs are elements of ideology by which thoughts are disseminated in society. For example, 'Female hips can expand but not their brains', The thought of woman and a horse's mane go only in one direction', 'Woman might give birth to a wise man, but is never wise herself' etc. Such proverbs belittle women's nature and capabilities in order to justify the social predominance of men (Medhin, 2004).

As a result of the above broader traditional expectations and traditional views, girls have not been viewed as having the same aptitude as boys in science, and it has not always been seen to be necessary to educate girls in science (Medhin, 2004). Girls have not been encouraged to enter scientific careers and parents have chosen to send boys to school instead of girls. Girls often bear the burden of domestic chores and early marriage; pregnancy often interrupts the schooling of girls; sexist stereotypes in curricula and the views of teachers encourage girls and boys into particular careers; and a lack of role models of women in science helps to maintain the status quo.

2.3 Factors contributing for female students' attrition in science education

2.3.1 Socialization and Gender Stereotype

Many literatures emphasis the environmental factors than the biological factors as being associated with the difference in achievement between males and females. According to Ettinger et al. (2001) gender differences in cognitive ability is narrowing. In studies conducted in America for example female students are observed to excel male students. These are indications of the fact that the difference is more due to societal factors than biological factors. In support of this, Eric (2000) indicated that the "brain is best at learning what it needs to survive-socially, economically, emotionally, and physically" (2000, p.2). It seems that the natural setting in which the female students is living and the environmental factors are more important. In this respect, Gardner (1993) reveals that the realizations of intelligences are determined by the cultural context.

The consensus of a large body of research is that no matter what the biological differences, much of the observed differences between males and females can be clearly linked to

differences in early socialization experiences (Ettinger et al., 2001). This is not enforced by parents and the society alone; it continues to be enforced by the school community. Early socialization in to appropriate gender role continues throughout the life of a human being.

The society at large and parents in particular have stereotyped expectations. Cross-cultural research indicates that the sex role is one of the first learned by individuals and that all societies treat females differently from males (Elliott, 2000). Similarly, Bernstein et al, (2001) argued parents' different expectation for boys and girls are important early influences that are ultimately reflected years later in their performance. They wrote:

> *Teachers and parents may communicate gender role stereotypes about achievement including ideas about 'appropriate' areas of achievement for boys and girls. For example, if boys are expected to be better at science subjects and girls at reading, boys may receive more help and encouragement in science than* (2001, p.380).

Explanations for girls' for under-achievement in science which do look to the social sphere gender roles by family, school and society. Girls learn to conform to a stereotype of femininity a learnt gender role of such attributes as passivity dependence and sentimentality. In this situation, girls and boys find themselves in a position whereby they are placed within the contradictory position of having to be feminine; which means, avoiding success, or choosing particular subjects such as biological 'soft' science or humanities etc. According to Gilligian (1999) a female student risks deviation from the social norm in pursuing an intellectual or scientific education.

Experiences of girls, for example in the classroom learning environment have tended to influence negative attitudes towards the study of science subjects. A number of studies have shown that boys' more interaction with teachers in class than girls tend to influence better development of mathematical concepts among male students. Also the pattern of interaction in class tended to make boys appear more competent in math than girls (Astin, 1999). Boy's greater use of verbal and non-verbal language to dominate more of the teacher's time in terms of attention and classroom control is one of the influencing factors favoring boys in class (Keller, 2006).

2.3.2 Lack of motivation and negative attitude

A lot of research results show that attitude and motivation are more important than grades in determining which students drop out (Ajzen et al., 1999, Abbott et al, 2002; Bean, 2005; House, 2004). Dresselhaus et al. (2003) confirmed that female students drop out of higher learning institutions because they are being influenced by the academic as well as psycho-social factors they experienced during high school and even after they join college.

According to Dembo (1997) there is evidence that science is perceived by females as a male domain since the main users of science in careers are males. Thus, if females believe that the study of science is inappropriate for them, they will feel anxious about succeeding in the area.

Girls lack motivation in doing science which according to different researches, may be traced back to the way the child grew up. Achievement motivation tends to be learned in early childhood, especially from parents (Bernstein, 2001). Some studies found that the major reasons for the difference could be traced to the girls' lack of motivation in science education, low self-concept and negative attitude. Positive attitude and motivation, is an important indicator of academic achievement. It predicts students' success and retention (Lyons, 2005).

2.3.3 Academic Factors

Tinto (1997) goes on to mention that low levels of basic skills, an inadequate knowledge base and low self-confidence are all factors contributing to the failure and attrition of students in undergraduate programs.

The mode of study that a student chooses is often undertaken without prior knowledge of the implications (Tinto, 1997; Bean, 2005; Seymour et al., 1999). Therefore the issues explored by these researches such as the workload of the program and the courses within it, issues of new knowledge and little pre-requisite knowledge, issues of assumed independent learning when previous educational experiences did not promote this and not knowing student peers for support in program – are critical identifiers in the discussion of attrition and failure rates.

Bean (2005) wrote college success is often predicted based on how well a student has performed in high school. Students with very high levels of self assessed academic ability while at school displayed lower attrition rates than students with above average and average/lower levels of self-assessed ability. It is reported that academic self-concept is significantly related to students with the same academic preparedness were more likely to achieve higher grades as they develop greater confidence in their academic abilities.

Tinto (1997) reported that academic self-concept was significantly related to students with the same academic background were more likely to achieve higher grades if they had greater confidence in their academic abilities. Bean (2005) reported that successful students, who demonstrated a positive mental outlook, attributed this as the single most important factor that influenced their retention in college.

2.3.4 Faculty Environmental Factors

Environmental theory provides the basis from which to understand the relationship between students and the campus environment (Tinto, 1997; Bean, 2005; Seymour et al., 1999).

Hall et al. (1998) wrote that student affairs professionals can no longer ignore or underestimate the respective influence of the many on campus variables that simultaneously affect student retention.

Institutional barriers, sexism, and stereotyping in educational and professional contexts served as gatekeepers to women as they sought to reach their potential in science and develop identities as fully participating and legitimate members of the science community (Tinto, 1997; Bean, 2005; Seymour et al., 1999). Flowers (1998) cited in Leslie (2004) has investigated how the institutional factors' influences attrition in his recent research.

Women have made considerable strides in their quest for science. However, even though they no longer confront the open barriers faced by their foremothers, their full access to scientific knowledge continues to be challenged by those in power.

Some attribute the reason to the differential treatment of males and females that the teachers make in science classes (Hall et al., 1998) Differential treatment is exhibited in the family

and else where in providing support. In support of this, Dembo (1997) said that “There is evidence that counselors, parents and teachers don’t provide the same amount of support for females that they do for males in studying and valuing science education” (1997, p.448). Situations where for example teachers gave more attention to boys than girls in class, science related textbooks with gender bias and teachers reluctance to encourage girls to study science are among the factors considered to affect girls' attitudes as well as their performance in science related subjects (Astin, 1999). The findings that girls were frightened of science than boys and that girls were unsure of their mathematical ability is a result of influences through negative practices in the classroom.

2.3.5 Involvement Factors

Dresselhaus et al. (2003) emphasize the influence of faculty involvement on student retention and satisfaction with education. Overall faculty-student contact is an important factor in student achievement, persistence, academic-skill development, personal development, and general satisfaction with the college experience (Tinto, 1997). They also indicate that academic advising can reduce alienation and enhance learning.

The extent to which a student is involved on campus, accustomed to the academic culture of the institution, and connected socially to various components of the university community (i.e., faculty, administrators, student affairs professionals, and peer groups) has shown to be a reasonably strong predictor of student retention (Seymour et al., 1999; Tinto, 1987; Maxine, 2003). Flowers (1996) cited in Leslie et al. (2002), also found that student development counselors play a central role in supporting and increasing students’ retention.

Involvement theory affirms the belief that students learn best and are more likely to persist by becoming involved in the campus community (Tinto, 1997; Bean, 2005; Seymour et al., 1999). Involvement factors are those variables that occur within the college environment and focus on specific ways students get involved. Some involvement factors are:

(a) Student-faculty interaction,

(b) The role of the mentorship, and

(c) Participation in student organizations.

Students who have contact with faculty outside of the classroom are more likely to persist to graduation, exhibit higher levels of achievement, and be more satisfied with college than students not involved with faculty outside of the classroom (Tinto, 1997; Bean, 2005; Seymour et al., 1999). They reported that relationships with minority faculty proved to be the most significant dimension of social integration in affecting grade point average. Similarly, Flowers (1996) cited in Leslie (2002), reported that students who perceive a student-centered faculty and have opportunities for faculty interaction are more likely to adjust to college.

Research on mentoring indicates that students who have a mentoring relationship with their advisors/instructors feel professionally affirmed and are more productive (Seymour et al., 1999). Successful women in the field of science consistently report on the important role that their advisors play in their educational careers.

Tinto (1997) contends that students' academic success is primarily the result of the student relationship with the instructor/advisor. This assertion is supported by research on students' success. Seymour et al., (1999) on her research indicates that students, particularly females, who receive high levels of support from their advisors, are more likely to succeed in their education and persist to complete their degrees.

Tinto's Integration Model suggested that retention is related to the student's ability and actions to become an involved actor in her/his institution (Tinto, 1997). The Integration Model suggests the need for a match between the institutional environment and student commitment. A good match leads to higher student integration into the academic and social domains of college life and thus greater probability of persistence. Conversely, students are more likely to fail or leave a college when the match between the students and institution is poor.

According to Tinto (1997), academic integration stems not only from the student academic performance but also from the interaction with staff, while social integration reflects student participation in, and satisfaction with extra curricular activities and peer group relations. The theory argues that, all other factors being equal, a match between an individual student characteristic and the institutions academic and social components determine the student's commitment to university completion and the subject's commitment to their university.

These two final commitments, together with the levels of academic and social integration, have a direct effect on retention of students.

2.3.6 Personal Factors

Attrition resulting from new students feeling overwhelmed by, and being unable to cope with, the stresses that accompany the transition into college (i.e., attrition due to culture shock). (Tinto, 1997; Bean, 2005; Seymour et al., 1999) found that academic, social, and institutional adjustment were predictors of persistence and academic performance. Some research studies also argue that students leave or underperform in the first years at a university because subjects in the first two years are basic and dry (Flowers, 1996 cited in Leslie 2003).

Tinto (1997) reported the importance of the family in the retention of students. Similarly, Seymour et al., (1999) described the family as a source of support and encouragement. Positive, negative and non-significant relationships between course completions and parental occupation, and non-significant relationships between course completions and parental education has been also reported (Maxine, 2003).

Attrition triggered by lack of interest in, or enthusiasm for, the type of academic learning experience that characterizes college course work (i.e., the content of courses and/or the process of course delivery).

Attrition related to prolonged indecisiveness about, and protracted delay in making a commitment to, an academic major or career path. This is an additional stressor for students and was one of the attrition factors identified by Flowers (1996) cited in Leslie (2002).

Attrition caused by an absence of social contact with other members of the college community and resulting feelings of separation or marginalization. The issues of being away from home and having to deal with a new environment and the issue of accommodation and finding suitable lodgings may cause isolation (Tinto, 1997; Bean, 2005; Seymour et al., 1999).

The lack of collegiality in most laboratories or in the departments as a whole, contribute to a sense of isolation particularly among female students. The absence of female faculty

members and limited number of female students in science education added to female students' sense of isolation.

Attrition attributable to poor institutional fit that may stem from either of the following causes (Tinto, 1997; Bean, 2005; Seymour et al., 1999):

(a) Mismatch between the student's expectations, interests or values and those of the prevailing college community;

(b) Friction or frustration with institutional rules, regulations, policies, or procedures.

Attrition deriving from the student perception that the college experience is not relevant to real life outside the classroom or pertinent to personal and professional plans (Tinto, 1997; Bean, 2005; Seymour et al., 1999).

Attrition resulting from student unwillingness or inability to expend the time and energy needed to persist to graduation, which may stems from either of the following causes Tinto, 1997; Bean, 2005; Seymour et al., 1999):

(a) Weak initial intent to persist at college entry;

(b) Competing commitments or obligations to communities external to the college which pull away time and energy that would otherwise be committed to higher education

Other factors that have shown to be related to the attrition of students include family conflicts, parental support, personal problems, and health problems (Baumgrat, 2007).

2.4 Related Feminist Theories

Researchers have addressed the gender gap in the access, success and attrition in science the science fields from various standpoints. This paper considers the Western feminist theoretical framework, like essentialist, liberal and radical feminist theories and their educational applications.

2.4.1 Liberal Feminists

Liberal feminists, use psychology and sociology to critique theories that use biological reductionism to explain differences between women and men (Romanes, 2000). They argue

rather than using evidence of innate gender difference there is an over-changing hypothesis to justify inequality and perpetuate stereotypes.

Just as the inherent difference feminists' viewpoint is comparable to the 'nature' side of the 'nature vs. nurture' debate, the liberal feminists' viewpoint is comparable to the latter. Liberal feminists suggest that males and females are socialized to have different interests. In this case, females are less inclined towards science fields than males due to values and behavioral dispositions that are transmitted by society, family, education, and other influences surrounding them. Early in the study of socialized behavior, researchers believed that these patterns may be transmitted through direct socialization where children adopt actions that are typical or valued for their own sex when sex-appropriate actions are positively reinforced by parents, teachers, or other children and when actions associated with the opposite sex are negatively reinforced (Romanes, 2000). Later it was also shown that socialized behaviors may be transmitted through indirect socialization by children who choose to imitate gender appropriate behavior after observing those behaviors being positively reinforced when others of their own sex displayed them (Romanes, 2000).

The liberal feminists argue, especially in the case of the physical sciences, occurs through the influence of two major social arenas:

(1) The education system (teachers, professors, peers, curriculum, etc.) and

(2) Everything else outside the education system (such as parents, television, or society)

One example of direct training from the non-educational arena is the social stereotype which discourages females from the sciences education by portraying the physical scientist as male (Harding, 2003).

In addition, the standard-bearers, those characters that are portrayed as the super-human examples of what a physicist or chemist and the rest is and should be, often held views that greatly underestimated female capabilities. Although such stark stereotypes are no longer acceptable, stereotypes undermining the capabilities and interests of females in science fields still permeate society and the educational system.

Liberal feminists do not deny that females are found to be more interested in 'social science' or 'people science' like biology, or science that has direct social relevance. However, they

believe that those interests are trained rather than passed on genetically, and that the teaching and learning practices of science fields can be modified to neutralize these socialized differences.

In particular, the fact that females rapidly determine hard science like physics or mathematics to be irrelevant, but males do not, indicates that physics may be given more relevance through social training for males because they are more consistently encouraged toward and exposed to technical ideas (mechanical toys, tinkering, sports that employ physical concepts, etc.). The diminishing self-confidence and performance of females as they continue through the educational stages definitely contributes to their early departure from the field (Meinholdt & Murray, 1999).

Liberal feminists have many suggestions for improving female interest and participation. For them, there are two areas to contend with: social barriers that prevent females from studying science and socialization that influences females away from science education. To change the socialization process it is important to promote teaching methodologies that counter the barriers and influences (Gilligian, 1999). For example, one barrier that females may face is lack of encouragement.

Romanes (2000) indicates the liberal feminists' strategies involve altering socialization practices and making use of relevant legislation. This includes encouraging girls by showing them more female role-models in the sciences and indirect training for females to develop nurturing characteristics. Other solutions suggested from the liberal feminist perspective include using female friendly contexts and a broader world perspective in science teaching (Hazel et al., 2003), more equitable assessment practices (Bell, 2001), and employing well designed cooperative learning strategies (Pearson, 2005; Rosser, 2003) amongst others.

However, both viewpoints have a major limitation in that they focus on what is different about females (either in their biology or socialization) that leads them away from science rather than asking what is wrong with the science community in that it blocks the participation of diverse and able minds. In other words, the problem of girls and physical science may have more to do with the nature of the field of physical science than with the nature of girls (Gillibrand et al, 2004). This growing stance is the foundation of the radical feminist view.

2.4.2 Radical feminist view on Science Culture

The radical feminists suggest that science is not a gender neutral subject but rather is tightly bound by masculine tendencies and preferences (Romanes, 2000). Females that lack such tendencies might feel disinclined to the subject and/or alienated within the field. The patriarchal nature of hard science is transmitted in three ways: pedagogically, by transmitting a narrow message about what it means to do science rather than allowing for individuals to define it for themselves; academically, by defining what is acceptable science research and what is not, primarily through various peer review processes; and socially, through the structure, interactions, and treatment in the field.

An underlying perspective for the radical feminists' viewpoint is that science has been primarily a male endeavor for many centuries, while females have actively participated for only the past century or two. Thus, as Hazel (2003) indicated science is not "Neutral, apolitical, gender-free knowledge which just happens to have a masculine 'image'… [It] is strongly enmeshed with masculinity" (2003, p.875).

Among the sciences, physics is the most extreme in the male hegemony of its culture. The patriarchal nature of physics and math is more pronounced than that of the other sciences but many science education researchers believe masculinity exists for the sciences in general. Lederman (2003) sums it up persistently that,

> *Science is hegemonic and andocentric, two characteristics that proceed from the fact that practitioners of science as we know it have traditionally been male. It is they who define the rules, methods, instrumentation, descriptions of results, and criteria for knowledge production. It is they who define what counts as science, both theoretically and in practice. It is they who are the gatekeepers for access to, and definers of, a life in science* (2003, p. 604).

The science educator who assigns weight to this viewpoint believes that females face active and passive discrimination and have little or no role in defining the field. Thus, there is an intrinsic bias in the field favoring males. This bias is transmitted when science is taught and studied at all educational levels and through all other interactions within the field.

An example of the pedagogical transmission of masculinity is that introductory science is taught in a way that is often more unrealistic and abstract than necessary.

Radical feminists have an intervention to retain more women in the field. One of the pedagogical concerns of these feminists is that traditional teaching of science perpetuates elitist elements and does not expose students to all the ways in which science can be pursued in the world.

They believe the social transmission of patriarchal nature of the field through interactions within the field acutely affects the retention of females. The reason why there is low access and success and high attrition percentage of females in the fields of science is because as Bell, (2001) said "… in science departments around the country, women are feeling ill at ease, out of place, not at home" (2001, P.469). It is especially deterring for females to face discriminatory actions because research shows that it occurs more frequently for them, is a more negative experience for females than for males and that they are less likely to take action against it. The patriarchal nature of science is also noticeable at the lower educational levels in science classes with the intimidation of girls by boys during lessons (Seymour et al., 1999).

Additionally, "… in typical classroom activities, boys often dominate and girls receive less experience" (Bell, 2001 p. 470). However, when isolated from boys, girls in single-sex science classes gained more confidence than their co-educational counterparts, improved achievement, and subsequently the likelihood of their studying science especially the 'hard science' at higher levels was increased (Gillibrand et al., 1999). The patriarchal nature of science need to be addressed with action-oriented solutions that will help change the system from within. It is science educators, and education researchers that have to act in order to diversify and create an equitable field of science.

The Radical Feminists, like the Liberal feminists, also call for pedagogical change. However, the liberal feminists calls for pedagogical change at early stages to nurture female interest and it does not require that the field of science be changed itself. The radical feminists argue that changing female training in the hard science so that they fit in to the old mold is not the solution. They say "It is an attempt to remold females so that they satisfy the requirements of the community instead of remolding the requirements so that everyone can fit in" (Harding, 2003, p.435). On a long enough time scale the solutions offered by the liberal feminists camp may help improve the initial number of females enrolling but will not help retain them

because it will not change the structure and the patriarchal nature within the culture of science at higher levels. In addition, they suggest having single-sex classrooms to increase female confidence and persistence in science fields.

To fully recognize the socially constructed nature of science means, in part, to think about the gendered nature of knowledge, and to make problematic the political and academic stance that science, as a generalizable subject, with its specific discourse and epistemological traditions, represents all of human experience (Gardner, 1993).

However, resistance of science departments and instructors to change is a formidable barrier, especially since the change must come primarily from within the field. The first step is then to increase awareness within science departments of these issues and begin sensitizing all current members of the community to the idea of openness to different worldviews and approaches to science.

Chapter Three
Methodology

3.1 Methods of study

In order to explore the contributing factors to female students' attrition in science education in the Faculty of Science this research employed a mixed method of approach using quantitative and qualitative research methods, as these methodologies support each other and as both are important in research activities (Abelson, 1995). Employing both research methods helped to combine the strength and amend some of the inadequacies of any of sources of the data.

According to Mason (2002) the qualitative method is considered to be important to a researcher for evaluating the nuance of many social phenomena important to analyze gender problems in the stand point of participants. Therefore this study used qualitative research method to see and investigate factors which contribute to female students' attrition in science education the situation in depth and from the perspectives of the participants.

According to Dawson (2003) statistics and numbers play an important role in providing relevant and reliable information making rational decisions in a research study. Quantitative method was employed in order to amend some of the inadequacies of source obtained from qualitative research method and to quantify different factors for attrition of female students.

3.2 Study Area/Field Organization

This study was conducted in the Faculty of Science at Addis Ababa University, which is one of the largest and oldest higher learning institutions in Ethiopia. The Faculty of Science is located around Arat Kilo in Arada sub city, in Addis Ababa. The Science Faculty in Addis Ababa University is selected because of the high attrition of female students in the faculty and because of the proximity of the place to the researcher. Currently, the Faculty has six full-fledged Departments, Biology, Chemistry, Earth Sciences, Mathematics, Physics and Statistics, and sample for this study is selected from these departments.

3.3 Sample size used

The target population under investigation is currently female readmitted students found in year one, year two, and year three in 6 departments in the Faculty of Science. A total of 144 female readmitted students were identified from the name list of first year, second year and third year students who were registered in the second semester of 2010 academic year. Among this 65% (97) were taken purposefully to be participants of this study. Before selecting subjects included in the study, the population was stratified into 6 departments, Biology, Chemistry, Earth Science, Mathematics, Physics and Statistics. To ensure fair representation of female students from each department, stratified sampling technique was employed to select subjects included in the study. After such stratification proportionate number of subject in each department was selected using random sampling technique.

Although there is an assumption indicating factors as a result of difference in subject area studied, differential analysis did not made between these departments. This is because of the fact that some departments have less that 15 students who are members of target population. And this is not advisable in chi-square analysis (Abelson, 1995). After such stratification proportionate number of subjects was selected using random sampling technique.

The distribution of female readmitted across the six departments and the sample size is presented below.

Table 1. **Distribution and Sample Size of the female students in year one, year two and year three**

Department	Year one		Year two		Year three		Total	
	Readmitted students in dept.	Actual sample size	Readmitted students in dept.	Actual sample size	Readmitted students in dept.	Actual sample size	Total readmitted students in dept.	Actual sample size
Biology(EDR#)	-	-	-		21	14	34	23
Biology(SCR=)	0	0	*4	3	9	6		
Chemistry(EDR)	-		-		12	8	33	22
Chemistry(SCR)	9	6	6	4	6	4		
Earth Science(SCR)	7	5	1	1	4	3	12	9
Mathematics(EDR)	-		-		9	6	28	19
Mathematics(SCR)	4	3	4	3	11	7		
Physics(EDR)	-		-		14	9	21	13
Physics(SCR)	2	1	-		5	3		
Statistics(SCR)	5	3	1	1	10	7	16	11
Total	**27**	**18**	**16**	**12**	**101**	**67**	**144**	**97+**

EDR, Education student regular
= SCR, Science student regular
+ Response rate is 89 (3 third year biology (EDR) major, 2 third year chemistry (EDR) major , 1 second year chemistry (SCR) major , 1 first year earth science (SCR) major and 1 first year statistics (SCR) major students did not return questionnaires on the set date.

3.4 Sampling Techniques

3.4.1 Sampling Techniques for Quantitative Method

Only female readmitted students were purposefully selected for this study due to the nature of the study.

This study used probability and non probability sampling techniques. Probability sampling method particularly, stratified sampling was employed by the researcher for the reason that it helps to establish a greater degree of representativeness in a situation where there is a population consisting of subgroups of strata (Dawson, 2003). Therefore, all female

readmitted students in Biology, Chemistry, Earth Sciences, Mathematics, Physics and Statistics Department in the faculty in year one, two and three are represented in the sample. The pattern of selection of sampled student of each department and was based on random sampling technique. The sampling frame was prepared based on listing names of all female students who have been readmitted in each department and year in the faculty. Sample for the study in each department and year was selected based on simple random sampling until the required number from each department and year was achieved using percentage of probability proportionate to size. For example, among the total of 4 biology major second year female readmitted students, these 65% of 4, 3 female students were selected to be actual sample size for the study.

Among the total number of female readmitted students, (144), 65% (97) of them were purposely selected to take part in the study.

3.4.2 Sampling Techniques for Qualitative Method

The researcher used purposive sampling technique to select key informants for in-depth interview, and for focus group discussion. Female students who had withdrawn voluntarily and been put on academic probation were selected purposely to participate in the in-depth interview and focus group discussion. The reason to employ purposive sampling technique was that because the researcher had aimed to select those who have direct relation to the issue of attrition so as the researcher will collect relevant and detailed information. The reason for their withdrawal including telephone numbers and addresses of both the former and the readmitted female students were obtained from the files in the Registrar Office at the Faculty of Science.

Among 11 students who were selected purposefully for the in-depth interview, 8 were readmitted (5 put on probation and 3 volunteer leavers) and the rest 3 left the faculty permanently (1 got dismissed and 2 voluntarily left).

For the focus group discussion, a heterogeneous group which consisted of 7 readmitted students were selected i.e. the participants were selected to contain representative samples of female student with different characteristics (department, year, educational background, mode of departure, campus residential status, living arrangements and means of tertiary entry), of the faculty.

Some of the readmitted students from the focus group and in-depth interview were later participated in the survey.

3.5 Sources and Instruments of data collection

3.5.1 Data Sources

The major sources of data for this study, primary data, include the information gathered from questionnaires distributed for 97 female students, 11 in-depth interview informants and 7 focus group discussants. Data was also collected from key informants from department heads, gender expert and the undergraduate associate dean in the faculty who the researcher believed they have knowledge, experience, and responsibility for addressing the female students' attrition issues. Moreover, Secondary data for this study were obtained from the Registrar Office of the Faculty of Science and from the Statistics Office of the Ministry of Education. In addition to this, The Ministry of Education statistical abstract of 2004/05-2008/09, the books, and websites were also reviewed.

This study used two kinds of data collection instruments. These were questionnaire and in-depth interviews.

3.5.2 Instruments used to collect data

Questionnaire

This data collection instrument was used to obtain quantitative data from female readmitted students. Questionnaires were prepared and distributed to 97 female readmitted students to investigate factors for their attrition. However, only 89 returned the questionnaires, and so the response rate is 91.7%.

Participants are surveyed with factors contributing to attrition consisting of the socio-demographic, educational characteristics and motivation, attitude faculty course/instructor related and personal factors of participants. Based on the reviewed literatures and documents on the topic 42 questions were developed and adopted with due consideration of the socio-cultural and psychological context of the country.

The questionnaires were administered in the Amharic language to tackle the barriers of language. The translation of items has been checked by Colleagues of English language students from Graduate Studies at Addis Ababa University.

In- depth interviews Schedule

Interview questions were prepared for 11 female students. Understanding women's perception from the standpoint of women themselves is a driving concern of the qualitative research methodology (Merriam, 1998). Thus, the format of the in-depth interview was semi structured which according to Merriam (1998) involves a schedule of open-ended questions followed by probing questions allowing the interviewer to ask general questions to draw out more specific information. These students were selected from 6 departments.

Focus group discussion guide were used for 7 focus group discussants. The format and the content of the guide were similar with that of in-depth interview.

The researcher also interviewed 4 department heads from Biology, Physics, Mathematics and Earth Science Department in the faculty. Besides four department heads, one gender expert and associate dean were also interviewed in order to investigate the factors for female students attrition in science education in the faculty. The key informants' interview guide was similar to all the informants in content and it was semi structured which involved a schedule of open-ended questions followed by probing questions.

3.6 Data Collection Procedure

The researcher had a list of names of the sample readmitted female students who are supposed to complete the questionnaire. The researcher met most of them in their dormitories and classrooms individually and in group as well. The researcher introduced herself to them and explained the purpose of the study. The researcher also guaranteed them the responses would be kept confidential and serve only for research purposes. After getting their consent, the researcher distributed the questionnaire to the sampled students and made arrangements as when this completed questionnaires need to be returned back. For those sampled students whom the researcher didn't able to meet the adequately trained research assistants administered the questionnaire. A total of 89 out of 97 questionnaires returned the questionnaire on the set date.

The researcher used a purposive sampling technique to select 11 interview informants and 7 focus group discussants. After securing their consents, we arranged the place and fixed the date for the interview. Prior to conducting an interview, the researcher ensured them that their views and opinions are kept confidential. Following this, the researcher explained the guideline

of the interview and asked their consent to take notes of their responses. With their affirmative responses the interview was made to proceed.

The researcher sought the consent of the instructors and stakeholders to take part in the study, by explaining to them the purpose of the study and they all consented.

The researcher used a purposive sampling technique to select 4 of the instructors and 2 stakeholders, gender office expert and the associate dean for undergraduate students in the Faculty of Science. The researcher explained the guideline of the interview and asked their consent to take notes of their responses. With their affirmative responses the interview was made to proceed in their office on the set date with each.

3.7 Methods of Data Analysis

According to Merriam (1998) describes qualitative research as requiring "… a powerful use of the researcher's own mind and body in analysis and interpretation of the data" (1998, p. 21). Interviews are analyzed based on the following major themes: Attitudinal factors; Faculty Environment factors; Learning or Academic environment factors and; Personal factors that contribute to female students' attrition.

After questionnaires were checked for completeness and consistency analysis and interpretation was done through percentages, average mean and then presented in Tables. Some returned questionnaires were incomplete but all available data have been included in the analyses.

Chapter Four

Data Presentation, Analysis and Findings

The collected primary and secondary data has been analyzed and presented based on the specific objectives formulated for this study.

4.1 Access, success and attrition rate of female students at the Faculty of Science (based on secondary data)

The trend of access, success and attrition rate of female students, obtained from secondary sources, at the Faculty of Science in AAU has been analyzed and given in table 2, 3 and 4.

4.1.1 Access of female students at the Faculty of Science

Female underrepresentation in the science education is resulted from failures in both recruitment and retention. Female students' participation in science education in the tertiary level is highly limited as a result of the weak early performance of young female students in education at primary and secondary school (Medhin, 2004). Female students' access to Faculty of Science over the last five years is shown in Table 2. Though there is a good will to increase number of female students by the government compared to the previous times, the participation rate has increased about 36.5% (i.e. female enrolment has increased from 146 in 2004/05 to 387 in 2006/07, in between the pattern showed fluctuation in the academic years. However, there has not been registered substantial increment in size, and it is far from ensuring equity to female students in the faculty as a social category.

Overall, of the total 5112 students enrolled between 2004/05 and 2008/09 at Faculty of Science, only an average of 24.3% (1243) were female while the rest 75.7% (3869) were male. This indicates the far-reaching impacts on continued marginalization and underrepresentation of female students in the science profession and gainful related employment.

Table 2. Enrolment in the Undergraduate Degree Programs in the Faculty of Science [2004/05-2008/2009]

Academic Year	Female	Male	Total	Female (%)	Male (%)
2004/05(1997 E.C.)	254	998	1252	20.3	79.7
2005/06(1998 E.C.)	146	727	873	16.7	83.3
2006/07(1999E.C.)	387	672	1059	36.5	63.5
2007/08(2000 E.C.)	259	621	880	29.4	70.6
2008/09(2001E.C.)	197	851	1048	18.8	81.2
Overall (Average)	**1243**	**3869**	**5112**	**24.3**	**75.7**

Source: Faculty of Science Registrar's Office, December, 2010.

Researches show that the science gender gap relates more to attitudes than to aptitudes. Boys are more likely than girls to choose science subjects to study in higher education and to have more positive attitudes towards science generally (Slavin, 2005).

Female students disproportionally choose subjects that emphasize biological sciences rather than the physical sciences. Low enrollment in these fields of study resulted from a number of factors affecting females especially at different levels of schooling. The theoretical explanation is that as the liberal and radical feminists put it the traditional and cultural expectations of women in science seem to have an influence on subject choice and selection, also agreed with the above enrolment nature.

4.1.2 Access versus Attrition Trends at the Faculty of Science

To give the complete picture, there must be some data that substantiate the extent to which the positive enrollment is accompanied by survival in the system. The data, however, show disappointing picture. To the dismay of the Faculty of Science, Addis Ababa University, despite deliberate and continuous efforts to recruit female students so far, the number of female who graduate on the right period of time has been negligible. The already low number of female students in the field of science is being diminished further by the high attrition. Accordingly, as shown in table 3, female students' share in the Faculty of Science shows a larger proportion of attrition. A closer look at Table 3 reveals, for instance, that the Faculty enrolled equal number of female and male students, 143(50%), in Biology Department in 2006/07. However, only 21% (30) female students graduated in 2008/09, while the rest 79% (113) received academic dismissal or left the faculty. Male students also face the same problem, but the statistics shows it is not as severe as the females.

Table 3. Enrolment, graduation and attrition rates of Students in 2006/07(1999E.C.), 2008/09(2001) academic year by department

Department	Enrollment 2006/07(1999E.C.)				Graduation Rate 2008/2009(2001E.C.)				Attrition Rate 2008/2009(2001E.C.)		
	Female	Male	Total	% Female	Female	Male	Total	% Female	Female	Male	% Female
Biology	143	143	286	50	30	105	135	21	113	38	79.0
Chemistry	72	146	218	33	15	112	127	20.8	57	34	79.2
Earth Sciences	17	77	94	18.1	3	48	51	17.6	14	29	82.4
Math	67	134	201	33.3	18	142	160	26.9	49	0	73.1
Physics	56	135	191	29.3	3	102	105	5.4	53	33	94.5
Statistics	32	37	69	46.4	11	42	53	34.4	21	0	65.6
Total	**387**	**672**	**1059**	**36.5**	**80**	**551**	**631**	**12.7**	**307**	**134**	**79.3**

Source: Computed based on data obtained from Faculty of Science Registrar's Office, December, 2010.

All the departments seem to be less welcoming to female students than the male students. All of them have lost at least more than half their female students. For instance, the Department of Physics lost almost all of its female students 94.5% (53) among 56 and only 5.4 %(3) managed to graduate on the right period of time. Even the Biology Department which many female students traditionally attracted to, according to the liberal and radical feminists, it has lost 79 % (113) of them. Usually students who join Biology Department are those who enrolled by their merit and have better EHEEQE result as the department 'attracts more female students'. However, students' interest and better EHEEQE is not helping this department from retaining its students. On the other hand, female attrition rates in Statistics department (65.6%) relatively appeared better, in having lower attrition rate.

Taken together, the faculty enrolled a total of 387 female students in its regular undergraduate programs in 2006/07, of which it has lost about more than half, 79.3% (307), of them at the end of the 2008/09 academic year (See Table 3). As depicted in Table 3 female students in the Earth Sciences, and Physics Department were found to take the lion's share of the overall attrition.

Table 2 shows the number of female students recruited into the faculty of science has been low during the past five years, 24.3%, and these low numbers are diminished further when attrition (non-persistence) reduces the already thin ranks of female students in the field. Although insufficient recruitment as the primary causes of low female participation in the science fields, the reduction in numbers through female attrition is a serious concern. The

loss of students whether returned for another year or not usually results in greater financial loss and a lower graduation rate for the Faculty of Science.

4.1.3 Success of Female students' at the Faculty of Science

Similar to access, female students' success (as measured based on the percentage of female students graduates) over the last five years did not show a significant impressive change in terms of proportions. In fact, the figure has increased from 39 (6%) in 2004/05 to 14.5% (80) in 2008/09. The pattern of graduates from both sexes across fields of study also provided further evidence with respect to corresponding female under representation in the fields of study.

Table 4. Number of Female and Male Graduates over Five Years [2004/05 – 2008/09] period

Academic Year	Female	Male	Total	% Female
2004/05(1997 E.C.)	39	617	656	6.0
2005/06(1998 E.C.)	67	757	824	8.1
2006/07(1999E.C.)	54	482	536	10.1
*2007/08 (2000 E.C.)	80	551	631	14.5
*2008/2009(2001E.C.)	80	551	631	14.5
Overall	**320**	**2958**	**3278**	**10.8**

Source: Faculty of Science Registrar's Office, December, 2010.

Analyses of Primary data

4.2 Profile of surveyed respondents

The data in Table 5 present the personal profile of informants such as age, marital status, residential status and educational background etc. when they stopped or drop out.

Table 5. Profile of surveyed respondents

Profile	Female students (N= 89)	
	Count	Percentage
A. Age Group		
18-20	47	52.8
21-23	25	28.1
24-26	11	12.4
27-29	3	3.4
30-32	3	3.4
Total	**89**	**100**
B. Marital status		
Married	76	88.4
Single	10	11.6
Other	-	0
Total	**86**	**100**
C. Type of residence		
On campus	63	70.8
Off campus	26	29.2
Total	89	100
D. Pre- university Qualification		
Yes	7	7.9
No	82	92.1
Total	89	100
E. Financial support		
Yes	23	25.8
No	66	74.2
Total	89	100
F. Your EHEEQE score		
*197.6 (Average mean)		
F. Year of Enrollment		
1997(2003/04)	3	3.4
1998(2004/05)	4	4.5
1999(2005/06)	58	65.2
2000(2006/07)	9	10.1
2001(2007/08)	15	16.0
Total	**89**	**100**
G. The interruption or drop out made		
During the first semester in year one	42	47.2
During the second semester in year one	20	22.5
During the second year	18	20.2
After the second year	9	10.1
Total	**89**	**100**
H. Attrition Status		
Academic probation or dismissal	72	80.9
Left voluntarily	15	16.8
Other	2	2.3
Total	89	100

Source: Survey Conducted in March, 2010

4.2.1 Analysis based on socio-economic information of sample used

Respondents were asked their age category while they withdrew. More than half, 52.8% (47) of female readmitted students reported the interruption had been made while they were in 18-20 age categories. Some of them, 28.1% (25), reported they were between 21-23 age categories when the interruption occurred. Only 3.4% (3) survey respondents' reported they were 30 -32 years old.

Interviewees also reported that they had been 20-25 age categories while withdrew.

Data on the marital status showed the majority of the female subjects had been single while they withdrew. Table 5 above shows that 88.4% (76) among those who answered the question were found to be single while only 11.6% (10) reported they were married or in a long-term relation ship.

Among the interviewees only one individual was married and has a child, the rest were single, but 2 reported they were in a long-term relation ship.

Answering their residential status, as indicated in Table 5 above the majority of the survey respondents 70.8% (63) of had been on campus residents, while the 29.2% (26) rest had lived off campus.

Among 11 interviewees 6 of them were on campus residents and the rest 5 were off campus residents. 2 focus group discussants were off campus residents and 5 of them were on campus residents.

The more number of on campus residential status in the survey particularly indicates more number of the readmitted students probably had come places out of Addis Ababa. Some said they came from Gojjam, Tigray Region and others from Oromiya region. This may indicate the new environment and the new dormitory experience or previous educational or teachers quality in areas could have some contribution for their underachievement and attrition (Tinto, 1997).

When asked if they had pre-university qualification/certificate only 7.9% (7) of them reported they had, while the majority of the survey respondents, 92.1% (82), had no any pre-university qualification.

Similarly, none of the interviewees reported they had pre-university qualification. They reported they enroll to the Faculty of Science directly after completion of high school. This shows that they needed to complete their education in the Faculty of Science and do not afford dropping/stopping out.

Answering the question if they had had financial support 74.2% (66) of the survey respondents reported they hadn't had any financial support, while only 25.8% (23) reported they had. This reveals that the majority of the respondents had no financial support for school materials, photocopying etc. This was also revealed by the interviewees.

The pre- university educational background of the students is of vital importance to understand some of the major factors or contributing factors to female students' attrition in the faculty of science (Tinto, 1997; Bean, 2005; Seymour et al., 1999). The survey respondents' average mean of the EHEEQE indicates that the scores of the female students were 197.6. Female readmitted students are found to have low mean scores.

Like wise the average mean of the EHEEQE score for the interview was also found low, 228. Among 18 interviewees only 8 were admitted to the faculty by their merit, the rest were affirmative action beneficiaries.

It seems that the EHEEQE reductions for female students at admission seemed to have far-reaching negative implications of paying a price in terms of lowering students' self-esteem in general and academic self-concept in particular (Seymour, 1999). This further enhances the levels of anxiety and frustration experienced in academic situation and particularly if they are in competitive situations such as examinations whereby social comparison is the rule rather than the exception. With regard to this, there is empirical support for the relationship between academic self-concept and achievement in college (Tesfaye, 2004).

A qualitative data reveals, admitting with lower EHEEQE furthers discrimination and plight of female students as they are made to join any department in the faculty against their interest. An interview with a third-year female student in the Department of Physics said the following while explaining what her lower EHEEQE made her pay:

> *I knew it from day one that they are going to put me in the department of physics against my interest and get dismissed since I had admitted with lower scores.* (RPP3)

When the head departments were asked why there is high number of female attrition in their department they all cited the low academic background of the students is a major factor.

Therefore, the lower mean scores could be considered as predictors for their attrition. However, the fact that only the female students dropped out in significantly higher numbers indicates that there are other factors that need to be thoroughly investigated.

Respondents entered the faculty of science between 2003/04 (1997 E.C.) and 2007/08 (2001 E.C.). More than half of the survey respondents, 65.2% (58), reported they were enrolled to the faculty of science in 1999(2005/06) academic year. This result shows that the female students are at least delayed one academic year for graduation. They were supposed to be graduated in 2001(2008/09) academic year. 3.4% of the respondents should have been graduated two years back in 2005/06 (1999 E.C) academic year, they have not managed it though. Clearly, this delay in graduation results a major financial loss not only for the female students but also for the programs, faculty and university.

Survey respondents were asked when the termination or drop out was made. As the data in Table 5 illustrates, almost half of the survey respondents 47.2% (42) reported they received academic dismissal during the first semester while they were in year one and 22.5% (20) reported the interruption was during the second semester in the year one. Thus, most of the respondents, 69.7% (62) reported they withdrew during year one. However, 10.1% (9) of the respondents did so after the second year.

Among the interviewees 10 reported the interruption made during the first semester in the year one, while 4 reported it was made during the second semester of the same year. The rest 4 reported it happened during the second semester of the second year. It is worth mentioning some of the responses that one of the interview informants' from Biology Department (Applied) gave reasons why it happened in the freshman year:

> *I didn't know where I should focus more then. I used to collect and study exercise books of biology from teaching, even exercise books of previous year students. I overestimated the exams and as a result lacked focus.* (RPB3)

Another student said:

> *It had been a new experience for me and still is. I used to go to Nazareth School, private and girls only school*. (RVP1)

This result reveals that the lack of knowledge how and what to study as well as difficulty of adjustment to a new style of a campus environment at the 'freshman' year are contributing factors for high attrition during the freshman year. These finding agrees with Tinto (1997) in which students' feeling overwhelmed by, and stresses and new style of school aggravates attrition.

An informal chat conducted with an officer in Registrar Office at the Faculty of Science reveals that some female students received academic dismissal at the beginning or end of the graduating year, third year. According to him, when dismissal happens during the graduating years students are not allowed to collect their Student Copy unless otherwise they pay the cost sharing, an after-graduate tax repayment system (Wanna, 2004)

Evidently, the consequences of premature departure from university more severe in developing countries including Ethiopia where almost 44% of the population is living below the poverty line (World Bank, 2008), and where education is a main vehicle to escape from it. When interruption happens whether in the first year or second it has a devastating effect, especially when it happens at the third year, graduation year, it has the worst effect on most of the students. Attrition in our country is often associated with negative consequences for students, their families, and university administration. It can cause heavy unrealized costs to universities and families a students leaving university without having completed her/his study may also be exposed to various psycho-social problems. All of the interviewees told their life plans was disrupted, felt dissatisfied with college experience, suffered from being jobless and being engaged in minor jobs.

Survey respondents were asked to write their attrition status regardless of what they stated on the universities' Withdrawal Application Form. The majority of the sample of this study 80.9% (72) said they were put on academic probation, while 16.9% (15) reported they left voluntarily. The remaining 2.3% (2) reported they left the faculty due to other reasons.

However, volunteer leave can be due to academic problems. An interview with a first year Physics major student revealed the following kind of attrition:

Disappointed by my first semester result and my department, I withdrew and joined Law Department in the Unity University College. (RVP1)

The other volunteer leaver said:

When I see my mid result I decided to leave and come back with better preparation so as I could survive. (RVM3)

Another readmit female student said she made to leave involuntarily the faculty because she was late for registration. Her story is written in detail in the personal factors section.

Most of the attrition as understood from the above data occurred due to academic reasons rather than non academic. This result is inline with Tesfaye (2004) research that the cause for a great number of college dropouts was academic dismissals rather than non-academic reasons. Even the volunteer leave was due to academic reasons like fear of failure or hatred of major etc, and one interviewee reported due to health problem and other problems.

4.3 Female students' attitude towards science education

Research has confirmed that attitudes are linked with academic achievement and success (Gardner, 1993). Female students' positive attitude towards science education is an indicator of success.

Table 6.1 and Table 6.2 present the data collected through questionnaire. In these tables the attitude of female students toward the science education is clearly shown to determine factors to their attrition related to attitude towards science education.

A three Likert point type attitude scale has been analyzed to include the attitude of female students and it is placed in one part of the table below.

Table 6.1 Summary of respondents' attitudes towards science education

Items	Responses	Count	%
1. Science requires intellectual abilities more suited to men than women	**Agree**	54	62
	Neutral	16	18.4
	Disagree	17	19.6
Total		**87**	**100**
2. Women are as competent as men in the science fields.	**Agree**	22	24.7
	Neutral	23	25.8
	Disagree	44	49.5
Total		**89**	**100**
3. Women's strength is in the biological science than in physical science.	**Agree**	46	51.6
	Neutral	18	20.2
	Disagree	25	28.2
Total		**89**	**100**
4. Science related profession suits women as equal as non-science related profession.	**Agree**	27	30.4
	Neutral	11	12.4
	Disagree	51	57.3
Total		**89**	**100**
5. It is impossible for women to advance in science education and have family.	**Agree**	28	32.9
	Neutral	33	38.8
	Disagree	24	28.2
Total		**85**	**100**

Source: Survey Conducted in March, 2010

From the table above it can be observed that more than half of the survey respondents, 62% (54), agreed that science requires intellectual abilities more suited to men than women. Only 19.6% (17) of the respondents rejected the traditional view which considers women as inferior to take up natural science, while 18.4% (16) are found to have neutral attitude.

The following extract with an interviewee in the Mathematics Department is one reflection of such idea. She revealed an outwardly hostile attitude toward women, favoring the men:

> *I worked all through my assignments with males. I don't see the need to work with females. The women don't have enough intelligence to work things out for themselves…hadn't I have worked with men I wouldn't be in the third year now. (RVM3)*

Most of the focus group discussants also thought males are biologically good in subjects which involve mathematics unlike females who are better in language studies.

This reflection of traditional view is found to be reflected by one of the department heads. It is worthy to mention an extract taken from the department head while discussing what he did think that there is high female attrition his department:

> *… The female students either do not have the intellectual capability or they are essentially not smart enough, to deal with the hard skills. Learning hard science especially math and physics is not as easy as other soft skills. They need high creation and imagination.*

A lot of research results show that attitude towards one's education is very important in determining which students drop out (Ajzen, 1999, Abbott et al, 2002; Bean, 2005; House, 2004). The quantitative and qualitative result reveals that the female students consider women have less intellectual ability in science education. Female students often are treated as if they can have no intellectual competencies by male instructors. Thus, if females made to believe that the study of science requires more intellectual ability than they have, they will feel anxious about succeeding in the area and achieve poor grades (Dembo, 1997). Furthermore, this negative attitude of female of female themselves and some instructors towards their intellectual ability in science, has a damaging effect on interaction, since female students have to interact with them in the laboratory or classroom everyday. This results in lack of proper interaction and has negative effect on retention and performance.

Female students' negative attitude towards science education which according to liberal and radical feminists, is traced back to the way the girl grew up (Harding, 2003). Parents as well as most male and female teachers and students believe that girls are incapable of studying science, especially physical sciences and thus female students underestimate their intellectual capabilities towards science. According to these feminists' viewpoint Code (1999) as natural science has been primarily a male endeavor for many centuries it is considered to be tough and unapproachable for women. These kind of negative attitudes towards ones own academic ability has a negative impact on learning and performance (Elliot et al., 2003).

The finding above shows only 24.7% (22) of the survey respondents support the idea that women are as competent as men in the science fields. Almost half of the respondents, 49.5% (44), are found to have a negative view on female students' academic competence in science fields and 25.8% (23) of them have neutral view.

However, there were few students who reject this kind of stereotypical view on the competence of female students in science education. An anecdote from one focus group discussant shows this clearly:

> *In this campus, there are not many female students who score greater than 3 GPA especially in mathematics and physics, but many male students do. This is not because they are not born to do mathematical calculations rather it because of their household responsibilities while at high school.*

Majority of the female students attrite do not clearly reject stereotypes about a woman's competence in science related fields. This kind of attitude is a reflection of the prevailing social prejudices against women in science in the society (Romanes, 2000). Having such kind of traditional view towards their ability in their education affects academic result negatively as it lowers academic self-concept (Elliot et al., 2000).

As can be seen in the above table, 46 (51.6%) of the survey respondents, agreed that women's strength is in the biological science than in physical science. On the other hand, 28.2% (25) of the respondents reject the stereotypical attitude towards women's strength in physical science , while some 25.8% (23) have unknown attitude.

In connection to negative attitude towards physical science subjects a qualitative data with focus group discussants reveals the following:

> *Many female students usually are not interested to join physics or mathematics departments, when they do either they earn bad grades or get dismissed unlike biology.*

Responses from survey and interview reveals that the majority of respondents tend to believe that women are more successful in biological science than in the physical science. The theoretical analyses for this kind of attitude is that liberal feminists like the essential feminists, do not deny that females are found to be more interested in 'social science' or 'people science' like biology, or science that has direct social relevance. However, they believe that those interests are trained by family, school and society rather than passed on genetically. Therefore, the diminishing self-confidence in physical science subjects and performance of females in higher education definitely contributes to their early departure from the field (Meinholdt & Murray, 1999).

An interviewee from chemistry department illustrates such a reflection:

> *I always prefer to work in an office than in industries. Working in industries usually doesn't suit women.* (RV'C3)

In trying to identify the traditional stereotypes, females tended to be convinced that in addition to the science education, science related professions are usually a male domain and unwelcoming too. The absence of female role models in science profession is a major factor in perpetuating female students' lack of confidence to study science (Medhin, 2004).

Regarding women's ability to advance in science education and have family 32.9% (28) agreed that it is impossible for women to advance in science education and have family. More number of female students, 33 (38.8%), are found to have unknown view on the issue. 28.2% (24) female students reject the idea. This finding shows less variance on the negative and positive attitude.

However, in connection to family responsibility and educational advance in science education interview informant revealed the following:

> *It was always challenging to me taking care of my family and school. If you want your family and your school at the same time, you will loose either or both.*

In Ethiopian society marriage or family is accorded a high social value. There is a widely held belief that girls who succeed in science education and career promotion are somehow abnormal and face poor marriage or family prospects. This in return affects female students' retention and performance in science program.

Table 6.2 Summary of respondents' attitude towards science education

Items		Count	%
6. I had firm and specific interest in science education when I chose science education while at high school.	**Agree**	25	28.1
	Neutral	13	14.6
	Disagree	51	57.3
Total		**89**	**100**
7. Science field is difficult for me; I should not prefer to attend such program.	**Agree**	78	90.7
	Neutral	4	4.6
	Disagree	4	4.6
Total		**86**	**100**
8. I was confident that I would score good grades in my department.	**Agree**	6	6.7
	Neutral	16	18
	Disagree	67	75.3
Total		**89**	**100**
9. I' would have scored better grades if I were social science student.	**Agree**	79	66.7
	Neutral	8	28.6
	Disagree	2	4.8
Total		**89**	**100**
10. I desire to major in science fields in my future academic career.	**Agree**	19	21.3
	Neutral	11	12.4
	Disagree	59	66.3
Total		**89**	**100**

Source: Survey Conducted in March, 2010

As it is indicated in table 6.2 above, 28.8% (25) of the respondents had specific and firm interest in science education when at high school. However, more than half of them disagreed that they have interest in the science areas, while others, 14.6% (13), have neutral attitude.

To make the above data stronger it is important to put the following extract that is taken from an interviewee.

> … *When I chose natural science over the social science fields at high school it wasn't because I was very interested in those fields. I was immature. I had to choose one.* (RPM2)

She considers her decision to choose natural science over the social science as an "immaturity".

The quantitative and qualitative responses clearly state that the students chose the natural science field of study without prior knowledge of the implications. They don't consider the issues of pre-requisite knowledge, interest, ability etc. At a result of this, their decision made at high school continues to give them problem while they join university.

Ninety point seven percent, 78, female students agree that science field is difficult for them and they should not have preferred to attend such program. Only 4.6% (4) of them disagreed with the statement, while 4.6% (4) neutral view. This result shows most of the respondents believe science education is not for them.

Focus group discussants as illustrated above also show that female students consider science education difficult and impossible to succeed. This is also another reflection of traditional view towards women's ability in science fields of study.

Only 6.7% (6) respondents agreed that they were confident to score good grades in they department, while most of them 75.3% (67) disagree. 18% (16) of them have neutral view on the statement.

Most of the qualitative data respondents especially those from the physics and mathematics department reported they were about to get dismissed due to the perception of the difficulties of the study areas. A focus group discussant from the Physics Department said:

> *Everybody was saying we are about to go home when X-mass comes,* [first semester exam]. *I knew it that I was going to fail,* [እንደምጫር አውቀው ነበር።] *when I got assigned to the physics department.* (RPP2)

Both responses from survey and interview indicates that the students had had low academic self-confidence when take up their majors. Regarding, this finding Tinto (1997) reported in his research that low self-confidence is one of the contribution factors for attrition and failure. In support of this, Bean (2005) indicates that successful students, who demonstrated a positive mental outlook, is the single most important factor that influenced their retention in college. Therefore, negative attitude towards success in their study is a contributing factor for their attrition

Female readmissions were made to put their extent of agreement if they think they would score better if they were in the social science fields. Surprisingly, among 66.7% (79) female readmitted students agreed that they would have earned good grades if they had been a social science student. Only 4.8% (2) disagreed that they wouldn't, while the rest, 28.6% (8) gave unknown view.

The same kind of opinion was reflected among the focus group discussants too:

By know we would have been at work like our friends in the social science campus. However, in this campus you rarely find a female student who is never been in academic probation for poor academic result.

The female students' tendency to trivialize the social science field of study and highlight the natural science field of study indicates the inapproachability of the science field of study for them. The radical feminists suggest that science is not a gender neutral subject but rather is tightly bound by masculine tendencies and preferences (Romanes, 2000). Females that lack such tendencies might feel reluctant to the subject and/or alienated within the field. As a result of this female students think that they would have scored better in the 'soft skills' rather than the 'hard skills'.

The survey also asked attitude if they desire to continue in the science fields in their future academic career. Even in the ideal circumstance, a greater proportion of the female students, 66.3% (59) disagreed to the statement. Only 21.3% (19) of them showed positive attitude in continuing education in science fields.

The above data is voiced as follows:

"ለ ጠላቴም አልመኘውም!", 'I don't want this [to further education in the natural science field] to happen even to my enemy.' (RPE1)

Their self-esteem to take up science fields in their future academic career is very low even this is reflected in the ideal circumstance.

Generally, the above data on Table 6.1 and Table 6.2 and shows that the female students have negative attitude towards their ability in science education. Research finding show that and positive attitude is a key component of learning (Huitt, 2003). Thus, lack of positive attitude towards the achievement in science education is one factor for the attrition.

4.3.1Female students' interest in choosing their major

In relation to attitude, interest is an important indicator for academic achievement. It predicts success and retention (Lyons, 2005). The dramatically high attrition rate of female students in the Physics and Mathematics Departments showed that the question of how these female students had been attracted to the departments should be clear. Therefore, it is important to

investigate how the readmitted students were being 'attracted' to their respective departments.

Table 7. Summary of responses on the reason choose their major

		Count	%
The most important reason for choosing their department	high performance in related subjects while at high school	22	24.7%
	Discouragement by conceptual difficulties of other departments.	28	31.5%
	I was assigned by the faculty against my interest.	35	39.2%
	Other	4	4.5%
Total		89	100.0%

Source: Survey Conducted in March, 2010

When asked the most important reason to join their respective departments in the faculty of science, a large proportion of them 35 (39.2%) reported that they did not choose the field of study that they are currently enrolled in rather they were assigned by the registrar office's through a quota system. Usually this is based on their school leaving certificate performance. 24.7% (22) reported the most important reason was high performance at school. 31.5% (28) reported they were attracted to their department because of the difficulty of concepts of other departments. This shows that they were not fascinated by the subject rather they thought they are better than the other departments.

In connection to this survey finding, some had joined department without any exact interest or due to fear of other subjects like physic and mathematics. Biology major third year a student says:

> *… I was advised by my friends and family to choose biology as it is easier to earn good grades than other departments. … If I were made to join the physics department for example, I would have been dismissed.* (RPB3)

The following extract describes the lack of interest in the 'hard science' also come from fear of future professional career related with the areas.

> *Physics and Mathematics is a very male dominated area and because I am female I would have to work very hard to get anywhere in academic or professional career. It seems it would be very difficult, even impossible to pursue it.* (RVP1)

An Earth Science readmitted student said:

> *I really don't want to work in the field, ground, after I graduate. It is not just comfortable for girls.* (RPE1)

These female students tend to abandon physics and mathematics, including Earth Science 'masculine fields of study' and join biology, 'feminine field of study', department. There is empirical evidence by the liberal and radical feminists (Romanes, 2000) which describes especially physics and mathematics is unapproachable field of study for women due to the women's socialization and the masculine nature of the fields. This stereotype of gender role is embedded in female students' thought and practices through various kinds of formal and informal education, such as school, family, and society (Code, 1999).

Female's lack of interest in mathematics and science also come from parents, or society in general, all of which discourage females from entering traditionally male-dominated fields such as mathematics and physics (Romanes, 2000). According to Pearson (2005), there is a connection between interest and effort. In other words, the more the students are interested and have positive attitude towards their majors, the more effort they will put into it and become successful.

4.5 Contributing factors for female students' attrition

4.5.1 "Faculty Environment"

Survey respondents in this study were asked to position the factors various conditions that they perceive to be major factor or a contributing factor for their attrition assuming faculty environment. Table 3 shows the six factors that elicited the most response.

Table 8. Summary of responses on factors related to faculty environment

Items	Responses	Count	%
1. Unfair grading system	**Yes**	34	38.2
	No	55	61.8
Total		**89**	**100**
2. Competitive atmosphere	**Yes**	34	38.2
	No	55	61.8
Total		**89**	**100**
3. Absence of interaction with other students for support	**Yes**	80	89.9
	No	9	10.1
Total		**89**	**100**
4. Sexual harassment	**Yes**	40	44.9
	No	49	55.1
Total		**89**	**100**
5. Insufficient academic support and counseling sessions from the faculty	**Yes**	85	95.5
	No	4	4.5
Total		**89**	**100**
Other	**Yes**	9	10.1
	No	80	89.9
Total		**89**	**100**

Source: Survey Conducted in March, 2010

Unfair grading system

Thirty eight point one percent, 34, of the interviewees cited 'unfair grading system' as a contributing factor for their attrition. More than half of the survey respondents 61.8% (55) reported that unfair evaluation was not a problem.

However, an interview with a third year Mathematics major student brings the issue into picture. She has the feeling that she studied as hard as she could, but always she gets unexpected grades:

> *At school, if you know the subject matter and can apply it you get a good result. But here* [at the Faculty of Science], *assessment is focused on selection. At university only a very few students get good grades through out the semesters. The majority of the students only suffer from poor grades. (RVM3)*

In relation to unfair grading system discussants in the focus group discussants said:

> *You can't miss a single class even you are in trouble you can't control. …As we are very few in number in our department we are easily recognizable by our instructors unlike the men. You are under their*

spotlight. Some instructors didn't even see your exam papers because they think they know you.

A close look on the above quote particularly in the focus group quotation shows the few number of female students in the faculty exposes them not only to isolation but and to unfair grading system treatment.

Competitive atmosphere of the faculty

Female readmitted students cited 'Competitive atmosphere of the faculty' less frequently as a factor i.e. most of them 61.8% (55) of them reported this was not a factor, while some 38.2% (34) cited it as a factor. However, this was at least a contributing or a major factor for more than a quarter of the survey respondents.

The following extract from the focus group discussion helps explain the perceived social climate of the faculty environment:

It is very different from other faculty in Addis Ababa University that we know. Some even refer this campus as 'ሰይጣን ሜዳ'. [The devil's, place].

One possible explanation for citing competition as a factor for their attrition is that female students have different learning styles unlike male students. Research studies show that girls are more effective in cooperative learning style rather than competitive learning approach which put girls in disadvantage than the boys (Rosser, 2003; Pearson, 2005).

The atmosphere in the faculty is probably common to other science faculties due to the masculinity nature of the field study (Romanes, 2000). Essentially female students are expected to follow a male model of academic success involving aggressive competitive relations with peers (Romanes, 2000). Relatively few female students are willing to adapt to the male model of academic science, which involves an aggressive, competitive stance.

Although these problems may not, on their own determine whether they succeed, it affects the quality of life in the faculty. This kind of faculty atmosphere, competitive and impersonal, often discourages capable minds from success (Tinto, 1997).

Absence of interaction with other students for support

Large number of the female attrite, 89.9% (80), reported absence of interaction with other students for support was a contributing factor, while only 10.2 %(9) cited this item not a contributing factor. Thus, absence of interaction with other students for academic support was a factor for the majority of the readmits.

An anecdote taken from an interviewee made this very clear:

> *The assignment which can be finished in one hour, used to took me three or more days to finish because I have to search for somebody who can help. (LDM3)*

Another interviewee strengthens this:

> *… I rarely find the necessary information for exam in my lecture notes. So I always want somebody for help. But no one helps you….they don't help for fear you might excel them in the exams. (RPE1)*

Another focus group discussant described the environment in her laboratory and class as:

> *A very independent study and work, you do your own thing. No one helps you.*

Responses from the quantitative respondents and interviewees reveal that absence of interaction with students in the faculty environment for academic support was a contributing factor for the majority. According to Kim (2001) knowledge is constructed through the interaction among people and with their environment; and learning science, students need to interact among themselves in addition to their advisor/instructors for a better result. The absence of interaction with other students for academic support whether in the classrooms or laboratories or anywhere in the faculty environment as a whole contributed to sense of isolation among the female students and affected their performance.

Sexual harassment in the faculty environment

When 44.9% (40) of the survey respondents cited sexual harassment was a contributing factor, 55.1% (49) of them cited it as not a factor. Some wrote names of particular instructors.

The following quote from second year biology major illustrates a devastating effect of sexual harassment on her in the educational career:

> *A particular instructor spoiled my grade just because I refused to meet him. He knew I had poor GPA. He posted my ID with other students on the notice board and wanted us to see him in his office. I saw him in his office. That day he asked me if he could see me somewhere out of the compound. I was shivering even I didn't ask why. He took my cell phone number and I went off. One day he called and told me to think about meeting him in private and to call him. I didn't call. I studied hard and well in my exam but it was 'D'. I knew I worked for at least for 'C'. I went to his office and ask him how that turned 'D'. He told me if I want my grade corrected I should at least kiss him on his cheek. I got angry left him there and went off. Had I been like the other girls in the compound I could have scored at least B. I am not like other girls though. (RPM2)*

Some ill-mannered instructors use their professional and gender hierarchy to reinforce and maintain their authority and control over the poor students in different ways. Especially those who have poor grades are more vulnerable.

Women suffer from different forms of sexual harassment everywhere; especially when it happens in the library it has a severe consequence as study requires more concentration. An unsafe learning environment can lead to compromise education as it distracts the student's attention while studying. A focus group discussant said:

> *I saw some ill-bred male student in the library take photos from female students' back when their trousers are slide a little….I did nothing though, what can you do*

Harassers use various actions ranging from sexual comments to sexual assault to make a woman aware; she is the object of sexual interest not an intellectual (Fagine, 1998). Request by male students and others to do them sexual favor in return to some kind of support accorded is one form of this:

> *I wished to study with male colleagues in my department as they are always better than the girls in my department, but I never did that for fear that they may seek for something else. My friends approaching males to ask questions*

> *were not getting good responses. The males in return appeal for sexual partnership. I never ask my teachers. (RVP1)*

All the focus group discussants reported the know friends who had good academic potential but received 'D' and 'F's just because they refused to see their instructors. However, a particular focus group discussant showed nervousness and reservation regarding sexual harassment by instructors and adamantly denied that such situations exist in the faculty.

After I heard all this plight of female students, I held a brief discussion with the gender coordinator of the faculty:

> *We are informed about incidences of harassments of female students by instructors or students, but no female students have ever reported to us. We tell to the students during the orientation when they first come to the university that they should report to us when they face any form of harassment. But, they usually don't report.*

Women are frequently whistled and shouted at the streets, chatted up in cafeterias, buses etc from their very earliest grades. Clearly, the causes of this behavior are deeply rooted in our society. So a female student internalizes this gender oppression and feels normal during such incidents. According to Gilligian (2004), for a female who had been in a situation in which she is encouraged to be unassertive, it is very difficult to express the problems she faces. Perhaps, telling may not change the situation.

It is understood that the learning environment should be conducive enough for male as well as for females for a better academic achievement. Sexual harassment whether unintentional, deliberately offensive, or downright illegal, influences combine so that women students face a chillier academic climate than their male colleagues (Gillibrand et al,. 1986). It is found that sexual harassment did not only make their environment chilly but also spoiled their result and academic carrier.

Factors related to insufficient academic session in the faculty

An institute should have regular academic support services and programs to help students integrate into the academic and social systems of the institution (Tesfaye, 2004).

This, means for almost all, 95.5% (85), of the survey respondents 'insufficient academic support in the faculty' was a factor. Only 4.5% (4) of the respondents cited insufficient academic session were not a factor for their attrition.

One third year biology major in the focus group discussion said:

> *There has never been provided tutorial class to our batch. There was an attempt last year; however it didn't even last a month.*

Huge numbers in the survey and the voice in the interviewees response for citing the absence of tutorial class in the faculty as a factor implies that had they get sufficient and regular academic support from the faculty, they would have survived or retained.

I had an interview with, gender office coordinator, as her office is responsible to "…follow up and coordinate academic support and counseling sessions" (Senate Legislation of AAU 2007: Pp 260) especially for the female students. In response to this she told:

> *We are very much aware of the problem. We created networking with, YWCA, an NGO, and supplied computers and separate libraries and financial aids for the needy women. The support especially the provision of tutorial classes in a regular base needs much money which the NGOs are not willing to do.* (2007, P. 260)

However, an interview with the Undergraduate Associate Dean at the faculty showed another solution:

> *Even it is not necessary to seek help from other organizations as it is our main concern. Instructors who have less than 9 credit hours are responsible to give tutorial classes for free. Graduate students who are currently enrolling in AAU for postgraduate program from different public universities have also a duty to*

give tutorial classes for free. We have 308 graduate students currently… I admit it is our fault not to caring our duties.

As indicated above (Please see Table 5) the majority of the survey respondents are affirmative action beneficiaries and believed they have little pre-requisite knowledge. Therefore, enrolling 'more' number of students and doing nothing to retain these students is equal to denying enrolling them. This implies provision of regular and sufficient counseling service or tutorial programs is one concern that the University in general and the Faculty in particular should take major.

4.5.2 Academic or Learning Environment

Researches show attrition triggered by lack of interest in, or enthusiasm for a content of field of study (Tinto, 1997). This can be also activating by advisor/instructor related reasons.

Table 9. Summary of factors related to learning or academic environment

Items	Responses	Count	%
1. hatred of my major/minor field of study	**Yes**	68	76.4
	No	21	23.6
Total		**89**	**100**
2. Workload of the program and the courses within it	**Yes**	9	10.1
	No	80	89.9
Total		**89**	**100**
3. new knowledge and little pre-requisite knowledge	**Yes**	71	79.8
	No	18	20.2
Total		**89**	**100**
4. lack of guidance from advisor/instructors during my academic difficulties for my progress	**Yes**	73	82
	No	16	18
Total		**89**	**100**
5. a particular instructor made my educational life miserable	**Yes**	36	40.5
	No	53	59.6
Total		**89**	**100**
6. Other	**Yes**	8	9
	No	80	91
Total		**89**	**100**

Source: Survey Conducted in March, 2010

Hatred of major or minor

More number of the survey respondents, 76.4% (68), cited 'hatred of their major/minor a factor, while some 23.6% (21) cited it as not a contributing factor for their performance. This

shows that the high loss of female students in the science faculty (Please see Table 6.1 and 6.2) has risen from lack of confidence due to absence of basic science literacy and self-concept that is needed academic success and for persistence. While deficiencies in students' academic preparation lead to attrition, research suggests that students' negative perception or in this case the feeling of insecurity of their major subject play an important role (Lyons, 2005).

Workload of the program and the courses within it

As indicated in the table above the majority of the female students, 89.9% (80), they cited the workload of the program and the courses within it was not a contributing factor. Few, 10.1% (9) cited this item as a factor.

In connection to this most of the interviewees reported workload of the program and the courses never been a problem.

New knowledge and little pre-requisite knowledge

As indicated in Table 9 above most of them79.8% (71) of the respondents admitted the problem of little pre-requisite knowledge on the area was a contributing factor for their attrition, however a few, 20.2% (18) reported not a factor. The low pre-university score result is inline with this finding. Tinto (1997) goes on to mention that low levels of basic skills, an inadequate knowledge base and low self-confidence are all factors contributing to the failure and attrition of students in undergraduate programs.

Lack of guidance from advisor/instructors

The majority of the respondents, 82% (73) female students mentioned that lack of guidance from an advisor or instructors a contributing factor. Only 18% (16) of them reported not a factor.

An interview with some of the department heads in the Faculty of Science/instructors believe that female students are not willing to come to instructors' offices. This is apparent from the following excerpt of the interview with one of the department heads/instructor in the faculty.

> *We usually tell our students to come to our offices whenever they have question. Males come to me immediately with a problem. Women mess off. They are not interested.*

The following are some of the expressions they used to explain why:

I usually don't see advisors because I don't have the confidence to communicate with them as I have little knowledge. (LVB1)

… I was always afraid of approaching my instructors. They are friends with the boys they even chat they are like brothers to each other but we female don't approach them. We only see them if we have trouble with our grades. (RPP3)

I don't approach the instructors because for fear rumors may go about me. Students might think I am seeing teachers to get special support or good grade. (RV'C3)

I don't think university teachers would listen to us if we go there for counsel. Some teachers in the college did not like interaction among girls and boys. (LVB3).

Clearly, these female students had lacked freedom for interacting with their instructors which they needed for learning. The focus group discussants also believe that instructors are not taking them their problems seriously and do not attempt to extend sympathy and support.

Ethiopian society is a patriarchal society that has affected interaction between men and women (Medhin, 2004; Tesfaye, 2004). Religion, culture demonstrate concern with the protection of female sexuality, which has implications for male–female interaction. Restrictions on the interaction of male and female have also constricted females' learning.

Thus, it is essential for advisors to realize that female and male students have unique and different communication style. It is helpful for advisors to gear their mentoring approaches towards individuals instead. Advisors/instructors should make an effort to work with all students, not just those with whom they are most comfortable. Teachers need to know the psychological make up of female students in their interpersonal interaction due to their socialization. Research Tinto (1997) on mentoring indicates that students who have a mentoring relationship with their instructors/advisors feel academically affirmed and is more productive (Seymour et al., 1999). There should be freedom to interact with colleagues as well as with the instructors/teachers.

In regard to this, considering the impact of socio-psychological make up Ethiopian girls/boys the Addis Ababa University Senate Legislation states that,

> *Each advisor or instructor has a responsibility of interacting with their assigned students,* [usually 20], *understand the strengths and weaknesses of their group through continuous and regular monitoring of their academic performance (2007, p. 133).*

Regarding this the associate dean of the faculty confessed 'advisors are supposed to write a report about the mentoring service they provide about their assigned students group, however we have failed to do so.' Therefore, counseling service is one thing that the university in general and the faculty in particular should think about at least in the BPR.

Factors related to instructors/advisors

40.5% (36) of the subjects reported a particular instructor made their educational career miserable. Most of them, 59.6% (53), cited this had nothing to do with their attrition.

Some participants in the interview revealed that some of their instructors promote chilly social climate especially during exams characterized by competition. According to a particular interviewee her instructor runs an idea of the "survival of the fittest.' She described her instructor:

> *His exams are very difficult and totally out of the objective of the course out line. He wants us compete against each other. But this is not really how learning should be. (RPE1)*

One discussant in the focus group discussion tells her second years' experience of such instructor who makes the faculty environment even chillier:

> *I knew an instructor who was terrible while I was a freshman student. He created a terrible environment for both female and male students by giving us many 'D's and 'F's. No student had ever gotten an A grade in his course. He was bad, although he had a good mind. A friend of mine decided to leave before finishing. (RPM2)*

These instructors seem to exert power directly and visibly and govern their mentality, ‘science is not just for everyone’, on female and male students who lack such competitiveness.

There are incidences where instructors see the females as not part of the class room. Some instructors believed students who are enrolled in science fields especially with affirmative action are not likely to survive and graduate. In particular, it is worth mentioning some of the responses that interviewees gave in this connection:

> *In 1990 most of the girls join the university with lowest* EHEEQE *result. I know a particular instructor in the first year who used to tell us we are going to go home all of us as we were enrolled with the lower preparatory score. He said ‘we know you will not survive; the Ministry of Education knows also you will not be here after the X- mass. They continuously told us we were about to get dismissed as the place is not for such students. (RVM3).*

Another interviewee said:

> *He* [her freshman instructor] *said to us 'you don't have anything to worry about; it is your lucky century; so you'll pass. (RVM3)*

Whether deliberate or not words which we don’t think are discriminating and are some times very harmful. It is like saying ‘hey guest, is it not time that you should leave, because it is not your home; it may mean you are in the wrong place, which is not meant for females. Are they there because they are woman or because they are qualified for the program? Besides, female students’ internalize their teachers' negative expectations, and act accordingly, self-fulfilling prophecies, and affect their learning.

This perception was clearly reflected in the interview with one of the department head/instructor when asked why there is high attrition rate for female students in his department. He stereotyped female students were as less capable and unfit. Such instructors simply could not take female seriously as students. A department head/ instructor from one of the department said: for example:

> *… There are very few female high achievers in our departments. I have been in this faculty for five years but there are only those female who scored an A*

in my course. …they are not just good in such fields I think. … They either did not have the intellectual capability or they are essentially not smart enough…

This sexist assumption is a barrier for smooth communication between an instructor and the female student. This attitude is a reflection of the prevailing social prejudices against women in science achievement in the society (Romanes, 2000). The stereotypes among men instructors in science also represent the failure of science to fight for social and intellectual transformation. This kind of attitude of these instructors is a formidable barrier; the change must come primarily from the science community, the instructors themselves.

In higher education, students are expected to develop a close working relationship with their instructor/advisor, a relationship that is crucial to the progress of the student through the program and out into the professional world though. Previous researchers have identified negative interactional patterns in male advisors relationships with their female students that lessen their opportunity for advancement (Tesfaye, 2004). Doubts remain unspoken, partly because of fear of giving the impression of, or actually being a failure. The support from department staff is very important for the students. Measures should aim at increasing communication and stimulating and supporting bonding between the academic staff and students.

However, the other two instructors put forward to explain female academic weakness free of such stereotype in the interview. They mentioned: lack of assertiveness in and out of the class room, poor academic background lack of interest in the field of study lack of parental supervision, blending other innocent female students to go out boy for extravagant activities their study time diverting them from their objectives.

4.5.3 Personal Factors

In addition to factors related to faculty environment, course or and instructors different personal factors are also found to impact female students' retention.

Table 10. Summary Personal related factors

Items	Responses	Count	%
1. had trouble balancing personal and school life	**Yes**	38	42.7
	No	51	57.3
Total		**89**	**100**
2. Not committed enough towards study, classed etc	**Yes**	21	23.6
	No	68	76.4
Total		**89**	**100**
5. Medical reasons (your own)	**Yes**	7	7.9
	No	82	92.1
Total		**89**	**100**
6. Medical reasons (of others close to you)	**Yes**	6	6.7
	No	83	93.3
Total		**89**	**100**
7. Juggling household responsibilities and study	**Yes**	24	27.0
	No	65	73.0
Total		**89**	**100**

Difficulty balancing personal life with school life

'Difficulty balancing personal life with school life' is found to be a contributing a factor for 42.7% (38) female students, while 57.5% (51) of them cited it as not a factor.

One face of this item among many is demonstrated below in the in the focus group discussion:

> *Girls having boy friends are always difficulties balancing school with their love affairs.…it is mostly their boy friends who arrange the time and place – thus boys plan and come to our dormitories to call their girl friends often after finishing their study – girls go out for fear not to disappoint them even though they just started studying, or to take a nap to study for the rest of the evening.*

The above response, among other things, indicates the existing power-relationship between men and women in our society. Boys make decisions about the time and place of meeting their lovers. Most female students among those interviewed also feel that it is the right way to do even though it is unfavorably affecting them academically. To a large extent, the tendency of female students to disregard their comfort and safety for the sake of others is due to their socialization differences which favor boys in on interpersonal relations at the expense of their own (Gilligian, 1982).

Commitment to study

Education in higher institution has always demanded a considerable time commitment and is generally a demanding experience. Few numbers of the readmitted female students, 23.6% (21) cited insufficient commitments to study as a major factor. Most of them [76.4% (68)] of them cited it as not a factor.

Similarly, the all of the focus group discussants with one exception agreed lack of study was not a problem. The following was an interesting expression they used:

> *ጥናትማ ዝንት ኣለም ነበር የምናጠናው:: [our study was non stop and continuous]*

This shows the majority of the female student sample in this study was willing to expend their time and energy needed to persist. Therefore, this indicated there should be focus to other factors related to studying methods and other related issues.

Medical reasons (your own)

Attrition due to medical reasons of their own was cited a contributing factor by 7.9% (7), while the rest 92.1% (82) cited it not a factor.

Medical problem of their significant other

Very few women, 6.7% (5) cited medical problems of their significant other as a contributing factor, while the rest 93.3% (85) cited it as not a factor. Statistically, the numbers seems very insignificant. However, reading the following stories from the interview informant reveals the impact clearly:

After she described she had left the faculty involuntarily, Chemistry third year major after she told she had left “involuntarily” she continues:

> *… I scored 2.60 while I was made to withdraw. The main reason I should leave is because I came late three weeks after the registration dead line. When I went to Dessie for my first semester vacation, I found my mother severely sick. There was no body to take care of her as I was the oldest of my brothers and sisters and my older brother had to go to work. It took her a little while to get better though. When she got better I left for Addis Ababa to resume my second semester education. I was told I was too late and missed many classes. (RV’C3)*

This type of gender role is usually trivial by our society including faculty instructors and administrators. She continues her story:

> *I told my advisor what happened to my mother, but this couldn't help me to convince them. They just didn't understand. My friends told me to get legal evidence and show the registrar. I went back to Dessie, got some witnesses to the court to prove my mother's sickness. The court wrote a letter to the faculty that proves my mother was truly sick. However this took me another four weeks. I explained my reason but nobody try to help me. I knew that doesn't have any negative impact on my grades but they just didn't understand. (RV'C3)*

This implies that the burden of taking care of the sick significant is still on the shoulder of female students on the cost of their education. The impact of their socialization trait and gender role which is assigned to female by society has cost this capable student her educational career.

Juggling household responsibility with school

Some 27% (24) female survey respondents cited 'juggling domestic work with school' as a contributing factor while, the rest, 65% (73), of them reported it was not a factor. This result suggests some bias against women in the domestic work. Providing dormitory to female off campus leavers would possibly alleviate some of these problems.

Societal attitudes towards marriage continue to aggravate female students' attrition from their education. A story with a former student discloses this:

> *I had a baby when I was in grade eleven. I discontinued school until she became two years old. I scored 204 despite of my situation. The saddest thing was I was assigned to Adama University. Every member of my family and his mother were telling me I should stay and look after my daughter. (LVB1)*

Their families and relatives not to mention the world around them—continue to reflect conservative gender expectations, girls may not see their academic achievements as particularly significant to them as they are women.

> *I really wanted to finish my education. I left my daughter with my mother. I went there ask for transfer to Addis Ababa University after some time with fake reasons. I got acceptance luckily. However, when I come here it wasn't easy for me to spend the whole time for study, juggling with baby care and school. Exams were very difficult for me due to my situation. I never told my situation to any of the people there. ... I was feeling like I was the only person in the whole university with this situation. I didn't even follow the routine procedures rules for withdrawal. I just left. (LVB1)*

In our society for a man to decide not to take his career seriously is like being silly, but for a woman to say she puts her family ahead of her career is considered a virtue; the pressures are all in that direction. The pressures come from society, relatives even the husbands' parents. When she finally gives her education up to her family said:

> *ደግ ኣደረግሽ!* [That is wonderful!] *ትምህርቱ ቀሰ ተብሎ ይደረሳል::* [You would resume your education after some time if you like]. (LVB1)

Pregnancy is discouraged and especially an undergraduate female who is pregnant is not usually encouraged to attend classes by her female or male colleagues or instructors in her normal health status. This kind of situation makes female students feel anxiety as there is no model to demonstrate how to deal with such issues. A particular focus group discussant reveals this fact:

> *I had a pregnant friend who left the faculty voluntarily. It wasn't due to medical problems that pregnancy had brought her. She had no clue whatsoever. She was afraid of peoples judgment even she was legibly married. She was telling me she felt bad when people stared at her.*

In the science fields where there are few women, support and understanding during such times is often not forthcoming and efforts to balance academic and such responsibility may be resent by many. There is a need for the faculty to show how to reconcile the academic career and personal career. It is commendable to mention what a focus group discussant joked about how to one can deal with such situation. She made a sense of humor to all of us but she made a nice point:

> *I think it would be interesting to see some of the women instructors or undergraduate female students get pregnant, so they could see how someone else deals with the situation.*

Especially, marriage, pregnancy and children are found to impact female's careers in academic career negatively**.** Marriage and children are generally viewed by people as obstruction to an educational career for women. The mutual exclusion of academic and family life has a long history though. Even when a choice between academic career and family is no longer an official requirement, the presumption that each role requires a female's total attention survives in our society.

Chapter Five

Summary, Conclusion and Recommendations

5.1 Summary

The major object of this study is to address the contributing factors that female students are driven away from the science education despite their desire to achieve good grades and graduate because of faculty environment factors, academic or learning environment factors personal factors.

The factor for the female students are found to be diverse and numerous. However, it is important to note that many of the female students in the survey results that the most commonly given factors for their attrition at the Faculty of Science in AAU can be described as faculty environment related factors and academic and learning environment factors rather than personal factors.

The female Students' pre-college academic preparation is found to be low. The averages EHEEQE mean of were, 197.6. The majority also they were not as well-prepared as their peers for the higher education. Therefore, it is safer to conclude the female students' 'being ill-prepared to accommodate the faculties' academic demand is proven to be a major factor. Furthermore, 71.9% (64) of them cited lack of pre-request knowledge in their major was a contributing factor. This suggests that the compelling reasons that female student attrite from the faculty is because they have simply poor academic preparation.

The majority of female students in the sample are found to be convinced with some social stereotypical attitude towards academic ability of women in science education. While deficiencies in students' academic preparation lead to attrition, students' negative academic self- concept plays an important role.

Eighty point nine percent, 72, of respondents indicated that insufficient provision of academic support session in the Faculty of Science was a contributing factor for their underachievement.

Large number of students, 39.2% (35) were found get assigned to departments through quota system against their interest and ability. Few of survey respondents cited factors related to unfair grading system, lack of commitment to study, sexual harassment and competition in

the faculty less frequently. However, interviewees indicated that like sexual harassment, knocking down exams unfair grading, and aggressive competition among students played a definite role in their attrition.

Some factors involve problems concerning academic help from instructors/advisors or from other male of female colleagues. Many of the interviewees had trouble of interaction with instructors. Others said they felt helpless they had no peers with whom to assignments. For instance, 89.9% (80) of respondents indicated a ‘lack of interaction with other students’.

Personal factors related to medical problem, marriage and other related issues were not a contributing factor for the majority of the sampled population. However, interviewees indicated that, personal factors played a definite role in their attrition.

Factors accounting for female students’ high attrition are wide-ranging and very much in keeping with those identified elsewhere. It is true that all the above concerns are possible contributors for their underachievement and attrition.

According to the result discussed in chapter four, there are very many factors that contributed female students to become a victim of attrition. The data collected from survey respondents and interviewees found out the outstanding factors behind high female attrition in relation to attitudinal factors, faculty atmosphere/environment factors, course or instructor/advisor factors, and personal/individual factors. The items discussed under each of these factors fall under the following major classifications.

a) Academic support and guidance and counseling that relate with previous academic experience, academic self-concept, inability to get continuous and need-driven remedial academic support etc.
b) Socio-psychological factors that relate with, attitude to science education, interpersonal relationship in the faculty environment including relationship with instructors, female classmates and dorm-mates, opposite sex students, and other psychological factors that affect their motivation to succeed in college etc.
c) Socio-cultural and health-related factors that relate with marriage, household responsibility etc.

5.2 Conclusion

Attrition of female students' at higher education is a major factor that should be examined. If female students are not graduating, they are generally not enrolling in higher institutions. This study argues that the emphasis on increasing female enrolment, but not doing enough to retain them to get through their studies is equal to denying females access to higher education.

The researcher is undertaking this research because of the reason that the already low number of women in the field of science is being diminished further by the high attrition. Such a persistent shortage of females studying science should worry the educators that there would not be sufficient workers or graduates to meet the needs of the new century unless the factors for such high attrition is identified and solved.

The findings highlight the need not only to ensure that girls enroll in higher education, but also that they are able to learn in a supportive, appropriate and safe learning environment.

The finding of this study proposes that female students who fit into the science academic culture are more likely to achieve good grades, while those who do not, have higher probability of attrition despite their high commitment to study. One's personal perception of not fitting into the culture of academics can originate from many sources, and has emotional as well as professional consequences. The main sources expressed by the respondents of this research concerned dissatisfaction with their major field of study and negative attitude towards the nature of science education.

This study suggests that one major caused of attrition in this study is negative academic self concept. Students who have more academic self concept more likely to persist while those who do not, have a higher probability of attrition. According to the liberal feminists female students' lack of confidence in science education arises from their socialization and gender roles. Radical feminists also argue the masculine nature of science subject makes it unapproachable field of study.

A student who is well-integrated in the system, who understands the academic progression, who has a good relationship with a mentor/advisor/instructor and sufficient guidance, will develop the necessary sense of belonging to persevere and persist with good grades. The remaining students are left to struggle and are made to feel inadequate because they do not fit

into the academic mold. They are not mentored, guided, or encouraged, and do not recognize the steps necessary to fit the mold.

The researcher also suggests that female students are less likely to fit the science academic mold. Responses indicate women had strong feelings about discrimination that should be looked into further by the faculty. A higher percentage of female students reported difficulty to communicate with their instructors/advisors and male colleagues.

Liberal and radical feminists offer a theory that explains the difficulty some female students have fitting into the science academic culture. Female students tend to view the academic competition as a typically male rite-of-passage. But, men recognize from their previous socialization that they must prove themselves before being accepted into the fraternity where they will receive the mentorship and reward that they need. Females do not tend to recognize the academic competition for what it is; they become discouraged and tend to blame themselves for the hardships that the competition imposes. Radical feminists also discusses that science selects students for fitting into the culture of science, resulting in a survival of the most similar, rather than of the fittest.

Therefore, findings of this study support the empirical finding that says undergraduate student attrition has more to do with what the student brings to the university than with what happens to the student after or before they have been admitted. This is because according to my findings also the majority of the respondents is found to be ill-prepared, negative attitude and has low self- esteem in their science education.

The researcher has identified problems with the female student experience for those who left and readmitted. These same problems may also affect the productivity and well-being of those who remain. For future work, the researcher suggests that a research be performed on female and male students who do attain the science education to compare differences between the two groups. What are the differences between students who succeed and not succeed? Comparing students who succeed with those who don’t may give more insight into this issue.

5.3 Recommendation

The researcher realizes that female students' attrition in the science education is a difficult issue to address. There is obviously no comprehensive solution to the problem because individuals are involved, and every student's background, goals, needs, concerns, and personality is unique. However, in light of the findings of the study, the following recommendations are put forward by the stakeholders, department heads and the researcher of this study as approaches to improve academic achievement and retention of female students in the faculty of science.

The Faculty of Science

1) Tutorial classes for female students with different or insufficient levels of knowledge from high school should be offered particularly for those who admit by affirmative action.
2) Admission policy system should be established and practiced for female students particularly for affirmative action beneficiaries to admit to departments without competing with male students.
3) Discussion forums and sensitization trainings should be formally and continuously conducted in the faculty to develop awareness and positive practices regarding the status of women in science.
4) An "Honor a Female Successful Science Student" practice where female successful science student are recognized and rewarded for good performance should be a tradition to motivate females in the faculty and enhance role modeling.
5) Violations of female students' rights should be taken seriously by administration and consequent measures taken to eliminate repetition without exception.
6) Special attention must be given to female students' advising in order to help integrate them both socially and academically into the faculty environment.
7) Gender trainings should also be obligatory for every instructor and advisor at the university especially at the male dominated Faculties.
8) Student advisors should post their consultation hours on their respective offices, give women and men feedbacks on their mid and final exams and report the result as well.
9) Hiring more female staff is strongly recommended so that young female students would see that they are welcome in the science field.

10) The duties and responsibility of the gender office should be well promoted so that females could get some help.
11) Instructors/advisors the gender experts and the associate dean and anybody who is responsible should encourage female students to attend their advisors/instructors office hours throughout all the semesters.
12) The Faculty's human power and financial resource should be fully and appropriately used to ensure gender equality at least in the BPR.

The Ministry of Education

13) Establish scholarship and community awareness programs to increase the number female students in science fields at secondary and tertiary level.
14) Focus on the gender dynamics in the science education and formulate adequate policies and guidelines that directly affect female students in higher institution of science education focusing on admission, support services, to alleviate the problems articulated in science education.
15) The teaching method at secondary schools should be designed to challenge students and motivate them to prepare adequately for college studies.

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Appendix A

Addis Ababa University

Collage of Development Studies

Institute of Gender Studies

Questionnaire to be filled *only* by those who had withdrawn in any case in the Faculty of Science.

DIRECTION: - This is a study developed to investigate **'*Contributing Factors to Female Students' Attrition in science education in the Faculty of Science'***. The information collected through the questionnaire and inventories below will be used for strictly academic ends, thus, confidential.

Now, the results to be arrived at, and the conclusions to be made about you would entirely based on the **care** you take while responding to each and every question. Hence, you are kindly requested to complete the forms set forth **honesty** and **carefully**.

N.B The booklet contents have 4 sections. Each section has its own instruction. Please strictly adhere to the directions, there of.

Please, page me on my cell-phone in case I lost you. [0911-16-73-81]

Helen Tesfaye,

Thank you

Please answer every item. If you think an item is ambiguous, feel free to write in what you mean by your answer. Some questions may appear redundant; they seek to distinguish details. There is no 'Right' or 'Wrong' answer in filling out the forms in section 2-3 as such.

Section 1: - Profile of Respondents
Please write your correct answer or circle the right item.

What kind of resident were you?	On campus	Off campus
Your age category is while drop out:	18-20 21-23	24-26 27-29 30 -32
Did you have financial support?	yes	No
Marital status	Marries Single other	

EHEEQE/ESLSE result	
What year are you now?	E.C.
Year you enrolled to the faculty of science	E.C.
Major/Minor area of study	
GPA while you stop or drop out	E.C.
Year you left the faculty	
The interruption or termination made	A. During the first semester in year one B. During the second semester in year one C. during the second year D. after the second year
Mode of Departure/Attrition Status	A. Academic probation or dismissal B. Left voluntarily C. other

Section 2: -Attitude of Respondents towards Science Education

Please use this 'X' sign to indicate the degree of your agreement or disagreement.
Response key: SA= Strongly Agree AG=Agree NU=Neutral
DA=Disagree SD=Strongly Disagree

Items	**SA**	**AG**	**NU**	**DA**	**SD**
Science requires intellectual abilities more suited to men than women					
Women are as competent as men in the science fields.					
Women's strength is in the biological science than in physical science.					
Science related profession suits women as equal as non-science related profession.					
It is impossible for women to advance in science education and have family.					
I had firm and specific interest in science education when I chose science education while at high school.					
Science field is difficult for me; I should not prefer to attend such program.					
I was confident that I would score good grades in my department					
I would have scored better grades if I were social science student.					
I desire to major in science fields in my future academic career.					

Please tick '√' the most important reason for choosing your respective department.

My main reasons for choosing my major were:

high performance in related subjects while at high school	
Discouragement by conceptual difficulties of other departments.	
I was assigned by the faculty against my interest.	
Other	____

Section 3: - Factors for female students' attrition

To what extent did the following affect your withdrawal (whether academic or personal withdrawal) the Faculty of Science at AAU? (Please place '√' on the provided columns)

II. Faculty environment:

Were the following items factors for your attrition?	**Yes**	**No**
Unfair grading system		
Competitive atmosphere		
was unexcited by my department		
Absence of interaction with other students for support		
Sexual harassment		
insufficient academic support and counseling sessions from the faculty		
Other		

III. Course or instructors /Advisor related reasons:

Were the following items factors for your attrition?	**Yes**	**No**
hatred of my major/minor field of study		
Workload of the program and the courses within it		
new knowledge and little pre-requisite knowledge		
lack of guidance from advisor/instructors during my academic difficulties for my progress		
a particular instructor made my educational life miserable		
Other		

IV. Personal:

Were the following items factors for your attrition?	**Yes**	**No**
had trouble balancing personal and school life		
Not committed enough towards study, classed etc		
no emotional support from family, friends, and others		
Medical reasons (your own)		
Medical reasons (of others close to you)		
juggling household responsibilities and study		
Other		

Thank you for taking the time to complete this survey. Please write any final thoughts or comments on the back of this sheet.

Appendix B

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Thank you so much for taking the time to do this interview. The purpose of these interviews is to investigate factors of female students for attrition in the faculty of science. Please feel free to expand on any of the questions that I will be asking you today. Before we begin, I would like to ask you if you wish to have your name listed as having contributed suggestions.

1. Demographic and educational background
2. What was your Mode of departure look like?
3. Were you confident that attending this faculty was the right decision? Why
4. Had you have a specific, firm area of interest in science education when you had started?
5. How often did you go to ask advice in your academic difficulty? Why if not frequently?
6. Why do you think there is high attrition rate for female students in science education?
7. What problems have you been experiencing in relation to the faculty environment, or your course of study or instructors, or your personal issue which you think contributed to your failure or stop out?
8. What were the main or the contributing factor for you to fail out/ stop out?

Appendix C

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Interview Guide prepared for Stakeholders

Thank you so much for taking the time to do this interview. The purpose of these interviews is to investigate factors of female students for attrition in the faculty of science. Please feel free to expand on any of the questions that I will be asking you today. Before we begin, I would like to ask you if you wish to have your name listed as having contributed suggestions.

1. What do you think are reasons there is high female students attrition in your faculty/department?
2. What factors do you think affects female students in science field of study?
3. What do you think are the main possible solutions to retain students?
4. How often do female students come to your office for academic support? What about men?
5. What actions would you recommend to be taken by faculty or department to reduce the rate of attrition?
6. What do you think it should be done to retain more number of female students?

Appendix D

List of codes of in-depth interview informants

1. RPP3= Readmitted, Put in academic probation, Physics major, Year two
2. RPP2= Readmitted, Put in academic probation, Physics major, Year two(another individual)
3. RPM2= Readmitted, Put in academic probation, Mathematics major, Year two
4. RPB3= Readmitted, Put in academic probation, Biology major, Year three
5. RPE1= Readmitted, Put in academic probation, Earth Science major, Year one
6. RVM3= Readmitted, Volunteer leaver, Mathematics major, Year three
7. RVP1=Readmitted, Volunteer leaver, Physics Department, Statistics major three
8. RV'C3= Readmitted, Volunteer leaver, Chemistry major, Year three
9. LDM3= Left permanently, Dismissal, Mathematics major, Year three
10. LVB3= Left permanently, Volunteer leaver, Biology major, Year three
11. LVB1= Left permanently, Volunteer leaver, Biology major, Year three

Declaration

I declared that this thesis is my original work and has not been presented for degree in any university and all the sources of material used for the thesis are duly recognized acknowledged

Name _____

Signature _____

Date _____

Place _____

This has been submitted for examination with my approval as a University Advisor

Advisor Name _____

Signature _____