

ADDIS ABABA UNIVERSITY
COLLEGE OF EDUCATION
SCHOOL OF GRADUATE STUDIES

PERCEPTION ON GENDER DIFFERENCE
IN MATHEMATICS ACHIEVEMENTS:
THE CASE OF JIMMA UNIVERSITY

By
ANDUALEM TAMIRU



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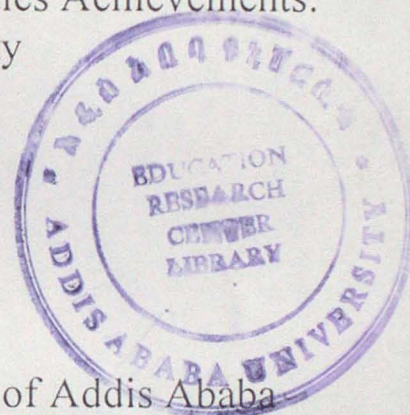
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Perception on Gender Difference in Mathematics Achievements:
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A Thesis Submitted to the Graduate School of Addis Ababa
University in Partial Fulfillment of the Requirements for the
Degree of Masters of Art in Curriculum and Instruction

By
Andualem Tamiru

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ABSTRACT

This study is meant to understand the perceptions of Jimma University female students and their mathematics instructors on females' mathematics achievements, and understand how some factors influence the females' perceptions. To do this; I used the qualitative research methodology and case study strategy. I held an in-depth interview, a focus group discussion, field observation and document analysis. I analyzed the data using the narrative analysis technique. I employed the social constructivist perspective of knowledge construction in learning mathematics. I found out that the female students and their mathematics instructors perceive that the female students have lower mathematics achievements than the male students. The factors that influenced the females' perceptions are the fact that female students are denied of their freedom of interaction that they required in learning mathematics; the learning environment is not meant for females' mathematics learning; they don't have role models and mentors in learning mathematics; they are seen as guests, and are forced into seeing themselves as guests in the mathematics class.

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Unit One

INTRODUCTION

1.1 Background of the study

Jimma University is one of the higher learning institutions in Ethiopia. It was first established in 1999 by the amalgamation of the two higher learning institutes - Jimma Institute of Health Sciences (established in 1983), Jimma College of Agriculture (established in 1952). The two campuses are located in Jimma city some 335 kilometers south west of the capital, Addis Ababa. Ambo College (established in 1931), located at Ambo town, 125 kilometers west of the capital, has also been affiliated to Jimma University as of May 2003 (Jimma University, 2004).

Jimma University (2004) is an innovative community oriented educational institution of higher learning. "The philosophy" of Jimma University is "community-based education". This involves identifying the problems of the society in the respective fields of study and conducting problem-oriented and community - based research.

Jimma University is also as an institution of higher learning, which is moving towards gender equity throughout the institution by the implementation of affirmative action (Jimma University, 2004).

As it can be observed in table 1, there is gender disparity in all the faculties, but the disparity shows variation across fields which involve mathematics and which don't involve mathematics. In the newly established technology faculty the number of graduates from the under graduate program in the year 2003/2004 was 120. But, only 2 were females while the rest 118 were males. The statistics is better in business and economics faculty - 55 females and 189 males. It is even better in the public health faculty - 65 females and 162 males (table 1).

Table 1: Graduates of Jimma University in 2003/2004 Academic Year.

Number of graduates from a college/ faculty	agriculture		Public health		medicine		business		technology	
	M	F	M	F	M	F	M	F	M	F
	205	31	162	65	185	20	189	55	118	2

Source: Jimma University 2004

Table 1 includes only those colleges and faculties which have bachelor degree graduates in that academic year. Thus, it does not include the education faculty, Ambo College and others which didn't have bachelor degree graduates that year.

In 2006 the number of faculties which have graduates in bachelor degree has increased to ten. However, gender disparity is still there. For instance, in the newly established law faculty the disparity is very large. I believe that it requires study. In addition, the gender disparity in the technology faculty remained almost the same as in the academic year 2003/2004 (table 2). While the other departments like business have shown remarkable change in closing the gender gap from that of the academic 2003/2004, which I believe needs further investigation. There is also significant disparity in the medical faculty. It seems that this also needs further investigation.

Table 2: The number of graduates of Jimma University in 2006

Jimma College of Agriculture & veterinary Medicine		Public Health		Medical Science		Business & Economics		Technology		Education		Law		Social Science & Humanities		Natural & Information Science		Ambo College	
M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
418	52	315	89	224	44	584	220	284	25	1550	286	302	9	130	12	37	15	519	125

Source: Jimma University (2006)

Does gender disparity in fields of study which involve mathematics to a greater degree such as the technology faculty, lead to the conclusion that females are not good at mathematics? I feel that it inspires for further study. That is, we need to study how the female students are achieving in mathematics at the different levels: primary, secondary, and tertiary levels. I also believe that the researches must be done with due emphasis on different contexts.

✓ From my experience as an elementary school teacher, as a high school teacher and a college instructor, I came to observe that there is variability in the achievements of mathematics among male and female students. In the private elementary school I taught, it was the female students who were having good achievements in mathematics than that of male students. The opposite happened in the high school and college level I taught. Why?

✓ Researches also indicate that there is gender disparity in the achievement of mathematics. According to Elliott et al, (2000) "there is little, if any, difference in the early years; boys begin to do better during the high school years" (pp 140).

✓ Various reasons are given for this difference between males and females in mathematics achievement. Some researches attribute the reason to the differential treatment of girls and boys that the teachers make in mathematics classes (Bernstein et al, 2000).

✓ Slavin, (1994) 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. Burns and Seligman share this view; "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" (Burns and Seligman, 1989 in Bernstein et al, 2000: 380).

✓ According to Dembo (1994) one reason for the difference in mathematics achievement is that females considered mathematics as male domain since the main users of mathematics in careers are males. Some researches attribute to interest and self-concept: "One study 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" Ackerman, Bower, Beier, & Kanfer, 2001 in Woolfolk, 2004).

Culture is also forwarded as a reason for discouraging females' achievement motivation (Bernstein et al, 2000: 380). Partial treatment is observed in many ways. According to Dembo (1994) "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 mathematics" (pp 448).

Thus, as cited above many literatures emphasis the environmental factors than the biological factors as being associated with the difference in mathematics achievement between males and females. After all we see from Jensen, (2000) that the brain is poorly designed for instruction; it is best at learning what it needs to survive-socially, economically, emotionally, and physically (pp: 2). It seems that the natural setting in which the female student 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.

According to Ettinger et al (1994) gender difference in cognitive ability is narrowing. In some cases the females are observed to excel the male students (Brandon, et al 1987). These are indications of the fact that the difference is more due to societal factors than biological factors (Dembo, 1994).

✓ Thus, I understand that depending upon the context and the natural setting of the learning environment, the gender disparity in mathematics achievements could be improved and even female students may achieve better than the males.

✓ In Ethiopia the gender disparity in mathematics achievement is prevalent and it seems that the disparity prevailed to a magnified extent. Kassahun and Kedir (2006) revealed

that in a study conducted on upper elementary students of private and government schools in Addis Ababa, mathematics achievement was strongly associated with student gender, and girls' achievement was significantly lower than that of boys. In their study, they employed both objective and subjective data-gathering instruments, which were applied to 309 boys and 302 girls drawn from 10 schools (five governments and five non-governments) on the basis of diversified sampling techniques.

- ✓ Sileshi (2001) also argues that girls begin to lag behind in mathematics at the elementary school level rather than in the secondary grades, at least in Ethiopian context. Sileshi (2001) attributes the difference to the girls' attitude towards mathematics and the school.

Contrary to the experience I had when I was teaching in the private primary school, the researches done in Ethiopia have shown that gender difference in mathematics achievement favoring males begin to be observed at the primary school level (Sileshi, 2001 & Kassahun & Kedir, 2006). I believe that this is because of the difference in the contexts. In the private school I had been teaching, many of the staff members including the directress were females. There was mothers' club led by the directress to discuss issues about their children's educational career. I also experienced that the parents were following their daughters' educational career with due concern. In any case, such disparities between actual experience and research provoke an investigation and scrutiny of the gender difference in mathematics achievements under different contexts and settings than covering the large population of schools through random sampling and generalizing to the whole population.

In this connection Elliott and others have the following about the importance of the context in determining behavior:

Context is an inclusive term that attempts to portray the complexity of students' background by identifying four major forces of development: physical settings, social influences, personal characteristics, influence of time (Elliott et al, 2000: 16).

role models in the environment. Some of the participants with strong mother or strong sister, who are leaders of the house as their mentor or role models, are seen to be high achievers.

- There is gender imbalance in the academic environment of the university as well as in the elementary and high schools from which these students at Jimma University came. As a result their self-perceptions of mathematics achievements are affected. Because:

- The female students are deprived of the motivation they could get from having a proportionate number of female teachers and instructors in the learning environment.
- The female students are deprived of the advantage they could have enjoyed from the ease of interacting with their teachers/instructors in the environment free of male dominance.
- The female students are deprived of the advantage they could have enjoyed in having a society which has a better perception of females' achievements because of the proportionate number of females in the academic environment and else where involving mathematics.

5.2 Conclusions

Some female students at Jimma University have the perception that in general the female students' achievements in mathematics are poor as compared to their male colleagues', even though there are individual differences among females in mathematics achievements. They see that studying mathematics is not paying for female students in that it requires many things which the females may not have. The mathematics instructors

as well have the perception that the males are better than the females in their mathematics achievements.

Some of the factors which contributed for the perceptions of the female students about their mathematics achievements are:

- Lack of freedom for interaction with colleagues, and instructors which they perceive as a requirement for mathematics learning.
- To have had a hostile environment in learning mathematics which deprived them of the concentration and peaceful mind which they believe is one of the requirements of mathematics learning.
- Absence of appropriate role model and mentor in mathematics learning.
- Being seen as guests in the mathematics classes.

5.3 Implications

The study implies that

- Gender education is a necessity both for all students as well as at least for mathematics staff members of learning institutions.
- The university needs to identify acts of harassments and have codes of harassments, so that it safeguards the female student against the attack from which the female student is suffering in campus.
- The society needs to get education as well as be able to see action which confirms that there is protection from the concerned body against any harassment of females so that parents will let their daughters to freely interact to colleagues any where.
- I believe that the affirmative action needs to enable the male students to see that females can do through creating an enabling environment for female

students. The community, the female students as well as the male colleagues should be able to see female high achievers in the scene so that they will be convinced of the female's caliber. The different parties should be convinced that the affirmative action is meant for creating an enabling environment for female students.

- Female student should be assigned in a field (department) where she could be successful and based on her interest. Parallel to her interest there should be appropriate counseling by professionals in her choice. I believe that this maximizes the probability of success both in the academic career as well as at work. Hence, convincing the society that females can do.
- There need to be a proportionate number of female and male mathematics teachers/instructors in the institutions. There should also be a proportionate number of female and male students in the institutions.

APPENDIX I

A. Discussion Points of the Interview Held with Student Participants

In here I described what I forwarded as a probing to initiate the participants to tell their stories in relation to learning mathematics. Up on the pertinence of the points to the research question, I have probing questions for student participants presented under seven categories:

↓ Her Educational background:

- About your achievement in elementary, in high school and in college.
- About your favorite subject in elementary, in high school and now in the university.
- About your first choice in the university.
- About your achievement in mathematics, physics and chemistry.
- About your reasons for change in your achievement if there was any.

↓ Her Family Background:

- About your position in the family (age wise)
- About your educational status and jobs of parents,
- About your relation with the family members.
- About their opinion on your educational career.
- About the condition in the family in relation to learning.
- About the condition in the family in relation to her learning.

↓ her school for females' learning and interaction

- About friendship, study partners.

- About interaction with instructors
- About relationship male colleagues

↓ **The university environment for females' learning and interaction:**

- About friendship, study partners.
- About interaction with instructors
- About relationship male colleagues

↓ **The community:**

- The culture of the society in relation to females learning
- The society's view for females' performance in academic career,
- The society's view for females' job.

↓ **Gender difference in educational achievement**

- About females' performance in education
- About males' performance in education
- Her choice of field in the university

↓ **Gender difference in mathematics achievement**

- About males' performance in mathematics
- about females' performance in mathematics
- About what influences your achievement of mathematic? And how?
- About your style of learning/studying vs. your instructors' styles of teaching?

APPENDIX II

B. Discussion Points with Mathematics Instructors

Up on the pertinence of the points to the research question, I have probing questions for mathematics instructor participants presented under four categories:

↓ About mathematics learning

- Nature of mathematics
- How do you teach mathematics?
- Addressing both female and male students in teaching

↓ About Females' mathematics learning

- Females' achievements of mathematics
- Comparing females' and males' in achievements of mathematics
- How do some factors affect females' achievements?
- The environment for females' math learning

↓ About Females' interactions

- female students visit your office
- Female students' interaction with you as compared to the males
- Their classroom interaction

↓ About the learning environment for females

- The schools,
- the university
- the society
- the family

REFERENCES

- ✓ Bernstein, Douglas A.; Alison Clarke-Stewart, Penner, Louis A.; Roy, Edward J.; Wickens, Christopher D. (2000). *Psychology*. Boston: Houghton Mifflin.
- Dembo, Myron H. (1994). *Applying Educational Psychology*. New York: Longman.
- Denzin, Norman K. and Lincoln, Yvonna S. (2000). *The Discipline and Practice of Qualitative Research*. Studies in Denzin, Norman K. and Lincoln, Yvonna S. (eds) *Handbook of Qualitative Research*. USA: SAGE Publications.
- ✓ Elliott, Stephen N.; Kratochwill, Thomas R.; Cook, Joan Littlefield; Travers John F. (2000). *Educational Psychology: Effective Teaching, Effective Learning*. Boston: McGraw Hill
- Ettinger, R.H., Crooks Robert L., Stein Jean (1994). *Psychology: Science, Behavior and Life* (3rd ed). Fort Worth: Harcourt Brace College Publishers.
- Gardner, Howard (1993). *Multiple Intelligences: The Theory in Practice*. New York: BasicBooks, a Division of HarperCollins.
- Janesick, Valerie J. *The Choreography of Qualitative Research Design: Minutes, Improvisations, and Crystallization* in Denzin, Norman K. and Lincoln, Yvonna S. (eds). *Handbook of Qualitative Research*. USA: SAGE Publications.
- Jensen, Eric (2000). *Brain-Based Learning: The New Science of Teaching and Training* (Revised). San Diego: The Brain Store Publishing.
- Maxwell, Joseph A. (2005). *Qualitative Research Design: an Interactive Approach* (2nd Ed). USA: SAGE Publications.
- Merriam Sharan B. (1998). *Qualitative Research and Case Study Applications in Education: Revised and Expanded from Case Study Research in Education*. San Francisco: Jossey-Bass.
- Ministry of education (2003). *Five Year Strategic Framework for Enhancing Female Participation in Tertiary Education in Ethiopia*.
- Ripley, Amanda (2005). *Science: WHO SAYS A WOMAN CAN'T BE EINSTEIN*. Time, Time Warner Publishing Amsterdam the Netherlands. 165(10): 48-57.
- Silverman, David (2001) *Doing Qualitative Research: A Practical Handbook*. London: SAGE Publications Ltd.

- ✓ Slavin, Robert E. (1994). *Educational Psychology: Theory into practice*. Boston: ALLYN AND BACON.
- Solomon Areaya (2004). *Qualitative Research: Beyond a Number Game*. IER – Flambeau, IER Addis Ababa University. 11(2): 1-12.
- Stake, Robert E. (2000). *Case Studies in Denzin, Norman K. and Lincoln, Yvonna S. (eds) Handbook of Qualitative Research*. USA: SAGE Publications.
- Schwandt, Thomas A. (2000). *Three Epistemological Stances for Qualitative Inquiry: Interpretivism, Hermeneutics, and Social Constructivism in Denzin, Norman K. and Lincoln Yvonna S. (eds) Handbook of Qualitative Research*. London: SAGE Publications
- ✓ Woolfolk, Anita (2004). *Educational Psychology*. Pearson Education: India.
- Yin, Robert K. (2003). *Case Study: Design and Method* (3rd ed). London: SAGE Publications
- Brandon, Paul R.; Newton, Barbara J.; Hammond, Ormond W. (1987) *Children's Mathematics Achievement in Hawaii: Sex Difference Favoring Girls*.
<http://www.jstor.org/Wed Apr> (date accessed November 2006)
- Holub, Jonathan (2001) *Addressing Sexual Harassment on Campus*
<http://www.gseis.ucla.edu/ccs/digests/dig9609.html#Constitutes> (date accessed February 11, 2007)
- ✓ Kassahun Tilaye and Kedir Bedru *Girls' Performance in Mathematics in Upper Primary Schools of Addis Ababa*. <http://ijg.sagepub.com/cgi/content/abstract/13/3/401.pdf> (Date accessed November 1, 2007)
- Kim, B. (2001) *Social Constructivism*. In M. Orey (Ed), *Emerging Perspectives on Learning, Teaching and Technology*, <http://www.coe.uga.edu/epltt/SocialConstructivism.htm>.
- Nyalunga, Dumisani (2007). *Dispelling the misconceptions and Myths about Gender*.
<http://www.academicjournals.org/INGOJ/PDF/Pdf2007/Jan/Nyalunga.pdf>

✓ Seleshi Zeleke (2001). Gender Difference in Mathematics Performance in Elementary Grades: Implications for Women Participation in Scientific and Technical Occupations. www.ossrea.net/eassrr/jun01/seleshi.htm (date accessed October 30, 2007)

✓ Thus, it is very important to give due emphasis to the context in studying the gender difference in mathematics achievements.

1.2 Statement of the Problem

As I mentioned above, my experience as a mathematics instructor has shown me that there is gender disparity in the achievement of mathematics at Ambo College. Jimma (2004) also reveals that there are less number of female graduates in the fields of study that involve mathematics as compared to those which don't involve mathematics or that involve mathematics to a lesser extent. Though, in the private elementary school I taught the males were less achievers in mathematics, it inspired my curiosity to understand why the females I taught at Ambo College turned out to be low achievers. This motivated me to understand this phenomenon in Jimma University. Thus, the purpose of this study is:

- ↓ *To examine and understand the female students' self-perceptions about mathematics achievements at Jimma University.*
- ↓ *To examine and understand the perceptions of mathematics instructors at Jimma University on the mathematics achievements of female students at the University.*
- ↓ *To examine and understand how some factors influence female students' self-perceptions of their mathematics achievements.*

In this research the questions that I am trying to answer are the following:

- ↓ *How do the female students at Jimma University perceive their mathematics achievements?*
- ↓ *What is the perception of mathematics instructors at Jimma University about the female students' mathematics achievements at the University?*
- ↓ *How do some factors influence female students' self-perceptions of their mathematics achievements?*

1.3 Significance of the study

This study feeds the educational activity in the university in that it helps in understanding females learning situation and its problems, especially in mathematics learning. It indicates some factors that can cause gender difference in mathematics achievement, and in finding ways of tackling the gender gap in mathematics achievement via understanding the factors.

I believe that this research serves as a springboard to embark on further research on gender difference in mathematics achievement in other or similar settings. It may serve as a reference, and as a database for future comparison in this area of research.

1.4 Key Terms

Perception

According to Woolfolk (2004) perception is interpretation of sensory information; it is the process of detecting a stimulus and assigning meaning to it (pp: 240). Thus, perception involves attaching meaning to a certain incidence-the stimulus, and "it is based on knowledge and understanding of the world" (Bernstein, 2000: 139). There are many factors that influence ones' perception such as "past experience and prior knowledge (Rock, 1983 in Bernstein, 2000: 139). Learning, maturation, emotions, and values are intertwined in perception (Elliott, 2000: 274). Bernstein (2000) reveals that the same stimuli may not result in the same perception.

Gender

Gender and sex seem to be confusing terms which people tend to use interchangeably. But, they are different in that 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 (Brannon, 2002; Deaux, 1993 in Woolfolk, 2004)

A good explanation about gender is given in the following excerpt from Nyalunga, (2007), "*Gender is a social construct. It refers to the relationship between men and*

women, girls and boys" (pp: 1). Thus, gender is what the society constructs and the individual shares in living within a given society. Nyalunga also quotes Carolyn Hannan (2000), as saying:

Gender relates to the attributes and opportunities associated with being male and female and the relationships between women and men and girls and boys (Carolyn Hannan 2000 in Nyalunga, 2007: 1).

Nyalunga further describes the attributes that are mentioned from Carolyn Hannan (2000) as:

These attributes, opportunities and relationships are socially constructed and are learned through socialization processes. They are however context specific and changeable. They are not static but dynamic. ... Gender is an integral part of the broader socio-cultural context (Nyalunga, 2007: 1).

According to Ettinger and others:

Gender identity refers to each person's subjective sense that "I am a male" or "I am a female" an identity that most of us form in the first few years of life. Both biological and social learning help us form our gender identity (Ettinger et al, 1994:439).

Thus, gender identity is a conviction that one belongs to the birth of (Elliott et al, 2000:133).

Sexual Harassment

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 (Dey, et al in Holub, 2001).

Holub sites an example of what is considered sexual harassment at institutions of higher learning from the University of Iowa's Sexual Harassment Policy. The following excerpt from Holub (2001) indicates the examples:

- *Physical assault; physical touching of any kind that is sexual in nature;*
- *Direct or implied threats that submission to sexual advances may favorably affect employment, work status, promotion, grades, or letters of recommendation, or that rejection of sexual advances may produce a negative effect;*
- *Direct propositions of a sexual nature;*
- *Subtle pressure for sexual activity, one element of which may be conduct such as repeated or unwanted staring;*
- *A pattern of conduct that tends to bring discomfort and/or humiliation, which may include comments of a sexual nature, or sexually explicit jokes, statements, questions, or anecdotes;*
- *A pattern of conduct that would tend to bring discomfort or humiliation to a reasonable person at whom the conduct was directed, which may include unnecessary touching, patting, hugging, or brushing against a person's clothing or body, or remarks about sexual activity or speculations about previous sexual experience (Holub, 2001:1).*

Self-Efficacy

According to Woolfolk (2004) self-efficacy is belief about personal competence in a particular situation. It affects motivation. Woolfolk (ibid) reveals that high sense of self-efficacy in a given area enables one to set higher goals, be less afraid of failure, and find new strategies when old ones fail. If our senses of efficacy are low, we may avoid a task altogether or give up easily when problems arise (Bandura, 1993, 1997; Zimmerman 1995 in Woolfolk, 2004: 369).

Unit two

LITERATURE REVIEW

2.1 Introduction

In this chapter I present what literature says about the issue of gender difference in mathematics achievement. In addition to describing what I think is going on in relation to the issue of gender difference in mathematics achievement, I describe the theories and beliefs that guide or inform my research.

Thus the issues reviewed and discussed are 'gender difference in mathematics achievement', 'factors contributing for gender difference in mathematics achievements', 'nature & nurture', 'motivation', 'social constructivism', and 'intelligences'.

2.2 Gender difference in mathematics achievement

Gender difference in mathematics achievement is prevalent. Kassahun and Kedir (2006) revealed that in a study conducted on upper elementary students of private and government schools in Addis Ababa, mathematics achievement was strongly associated with student gender, and girls' achievement was significantly lower than that of boys. But, according to Elliott et al (2000) the gender disparity is little in the early years; boys begin to do better during the high school years. While Sileshi (2001) argues that girls begin to lag behind in mathematics at the elementary school level rather than in the secondary grades, at least in Ethiopian context.

According to the American Association of University Women AAUW in Dembo (1994), there is evidence that the gender gap in mathematics achievement is narrowing. Dembo (1994) has the following:

In 1914, Maccoby and Jacklin completed a comprehensive review of gender differences and determined that females excelled at verbal tasks and males at mathematics and visual – spatial tasks. After 20 years, it appears that there are now few differences in cognitive abilities between males and females (Linn & Hyde, 1989). One exception is that males continue to score higher on the Scholastic Aptitude Test's (SAT, as of march 1994 called the scholastic assessment test) quantitative (mathematics) section. An explanation given for this difference is the fact that the test requires students to solve verbal problems quickly, and males may have some advantage in from gender – type activities (e.g.; questions derived from sports activities) (pp 448).

In still other research, females are seen excelling boys. The following is taken from American Educational Research Journal:

In a research under went on Hawaii public school among high achieving students in grades 4, 6, 8 and 10, indicated that girls have higher achievement levels than boys. The boys achieve their highest scores in mathematical reasoning and the girls achieve their highest scores in computation. High achieving girls out perform high achieving boys (Brandon, et al 1987: 437).

Though, there is variability in the extent of prevalence in different researches, it is observed that gender difference exists in mathematics achievement. So it is important to know the reasons for this gender disparity. So, how do some factors account for the differences in male and female achievements in mathematics?

2.3 Factors Contributing for Gender Difference in Mathematics Achievement

Different scholars gave various reasons for the gender disparity in mathematics achievement. Thus, some of the factors that contribute for this disparity are given below.

Early socializations: 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 (Slavin, 1994). This

socialization in to appropriate sex- role is not enforced by parents and the society alone; it continues to be enforced by the school community. Early socialization in to appropriate sex- role continues throughout life; the schools contribute to this socialization (Slavin, 1994).

Gender stereotype: 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 (Slavin, 1994). Parents' different expectations for boys and girls are important early influences that are ultimately reflected years later in mathematics performance (Doris Entwistle and David Baker, 1983 in Ettinger, et al, 1994).

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 mathematics and girls at reading, boys may receive more help and encouragement in mathematics than girls do (Leinhardt, Seewald and Engel, 1979 in Bernstein et al, 2000: 380).

Lack of motivation and interest: the girls may lack motivation in doing mathematics, which, according to 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, 2000: 379). Some studies found that the major reasons for the difference could be traced to the girls' lack of interest in the subjects and low self-concept in mathematics (Ackerman, Bowen, Beier and Kanfer, 2001 in Woolfolk, 2004:173).

Negative attitude: Sileshi (2001) argues that girls begin to lag behind in math at the elementary school level rather than in the secondary grades, at least in Ethiopian context, and attributes the difference to the girls' attitude towards mathematics and the school.

Differential treatment: Some attribute the reason to the differential treatment of males and females that the teachers make in mathematics classes (Hyde, Fennema, & Lamon in

Bernstein et al, 2000: 380). Differential treatment is exhibited in the family and else where in providing support. " 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 math" (Dembo, 1994: 448). Researchers have identified that there is differential treatments of males and females particularly by school teachers in classroom interaction (Slavin, 1994).

Female students' perceptions of mathematics as a male domain: According to Dembo (1994) there is evidence that mathematics is perceived by females as a male domain since the main users of mathematics in careers are males. Thus, if females believe that the study of mathematics is inappropriate for them, they will feel anxious about succeeding in the area.

2.4 Nature and Nurture

Human behavior and action is the effect of both biological and environmental factors. Taken in educational terms, the individual's ability or skill is attributed to the genetic make up as well as the way the individual has been grown up. That is, what she/he might have learnt from the school, the society, the family, peer group, and others. Gardner (1993) sees intelligences as both biological as well as social product.

There are indications that there is difference in the brains of male and female. The following is an excerpt from Ettinger (1994):

At least two major brain areas involved in the development of sexual difference: hypothalamus and the left and right cerebral hemispheres. Though, most evidence for sex differentiation of the brain comes from studies of nonhuman animals, particularly rats, it seems likely that similar sex differences exist in the brains of all mammals" (Thompson 1985 in Ettinger 1994: 441-442.)

Moreover, recently, technology is enabling scientists to read the brain of man as it functions and grows; accordingly, it is found out that males and females show different patterns of brain activity while reading (Shaywitz et al., 1995 in Bernstein et al, 2000). According to Bernstein et al (2000) sex difference is observed in another part of the brain also, and it is thought that this may lead to the difference in the skill that a female and a male outsmart one over another.

Amanda Ripley has written the following on the TIME Magazine:

Men and women have different architectures, and we don't know what they mean," says Haier. By administering IQ tests to a group of university students and then analyzing scans of their brain structure, Haier's team recently discovered that the parts of the brain that are related to intelligence are different in males and females.

... Among the girls in Giedd's study, brain size peaked around age 11.5. For the boys the peak comes three years later. "For kids, that is a long time" Giedd says. His research shows that most parts of the brain mature faster in girls. But in a 1999 study of 508 boys and girls Virginia Tech researcher Harriet Hanlon found that some areas mature faster in boys. Specifically, some of the regions involved in mechanical reasoning, visual targeting and spatial reasoning appeared to mature four to eight years earlier in boys. The parts that handle verbal fluency, hand writing and recognizing familiar faces matured several years earlier in girls. In a recent experiment with humans at Temple University, women showed substantial progress in spatial reasoning (Ripley, 2005:49-52).

Though, there is difference in spatial reasoning, it was conformed that it can be improved. Thus, it seems that the environmental factor is prominent over the biological factor in causing gender difference in mathematics achievement.

At this juncture, it is worth mentioning the nature of the brain, and the way the brain learns. Eric Jensen defines brain-based learning as "learning in accordance with the way the brain is naturally designed to learn." (Jensen, 2000:6). Jensen argues that teaching should be based on the needs and interests of the learner, which emanate from the

brain's design to ensure survival. In the book entitled "Brain Based Learning" Eric Jensen has the following:

The brain is best at learning what it needs to survive- socially, economically, emotionally, and physically...the brain is poorly designed for instruction. In fact, it is not at all designed for efficiency or order. Rather, it develops best through selection and survival. ...Although a brain-based approach doesn't provide a recipe for you to follow, it does encourage you to consider the nature of the brain in your decision-making. (Jensen, 2000:2-6).

So we see that the brain is an organ which works to adjust itself to the environment than to carry out instructions. Thus, the environment is very important determinant in learning.

2.5 Intelligences

Howard Gardner, pioneer of multiple intelligences, defines intelligence as "the ability to solve problems, or to fashion product, that are valued in one or more cultural or community settings" (Gardner, 1993: 7).

Earlier it was thought that intelligence is only linguistic and logical – mathematical, and it is measured by the IQ test (Gardner, 1993). Any one who scores low in the IQ test was thought to be not intelligent. The following is an excerpt from Gardner (1993):

Up until now nearly all assessment has depended indirectly on measurement of linguistic and logical – mathematical abilities; if students are not strong in these two areas, their abilities in other areas may be obscured. ... We believe that human cognitive competence is better described in terms of a set of abilities, talents, or mental skills, which we call "intelligences". All normal individuals possess each of these skills to some extent; individuals differ in the degree of skill and in the nature of their combination. ... (pp: 10 - 15)

Thus, other than being only linguistic and logical - mathematical, intelligences have now been thought of as multiple. Now that multiple intelligences have come to the scene, intelligences are considered to be diverse.

According to Gardner (1993) intelligence is both a biological product as well as a cultural product and intelligence depends on the context. This is apparent when he says:

Human beings are biological creatures but they are equally cultural creatures. ...The goals that parents set for their children also come into play from the earliest time: the father who wants his son to be a doctor or scholar will behave in a very different way from the father who desires an athlete, or who places the greatest degree of operational choice at a premium. (Gardner, 1993: 220-221)

Jensen's view of intelligence is in line with Gardner's view in that both emphasize the need for the context in the realization of intelligences. The following excerpt from Jensen, (2000) is indicative of this fact: "No intelligence or ability will unfold until or unless, it is given the appropriate model environment" (pp: 5)

Thus, no matter how intelligences are developed, their realization is doomed to a favorable environment.

2.6. Modeling

According to Woolfolk (2004) modeling refers to changes in behavior, thinking, or emotions that occur through observing another person – a model (pp: 320). Thus, it is very helpful to use modeling in achieving instructional objectives. For students who doubt their own abilities, a good model is low-achieving student who keeps trying and finally masters the material (Schunk, 2000 in Woolfolk 2004: 320).

Bandura feels that much of human learning is not shaped by its consequences, but is more efficiently learned directly from the model (Bandura, 1986 in Slavin 1994: 174).

Modeling when applied deliberately can be an effective and efficient means of teaching new behavior (Bandura 1986; Schunk, 1987, 2000 in Woolfolk 2004: 320).

Further more Bandura has the following on modeling:

Observational learning has four phases – attention, retention, reproduction, and motivational.

1. Attentional phase: the first phase in observational learning is paying attention to a model. In general, students pay attention to models who are attractive, successful, interesting, and popular.

2. Retention phase: once teachers' have students' attention, it is time to model the behavior they want students to imitate and then to give students a chance to practice and rehearse.

3. Reproduction: During the reproduction phase students try to match their behavior to the model's.

4. Motivational phase: the final stage in the observational learning process is motivation. Students will imitate a model because they feel that doing so will increase their own chances to be reinforced (Bandura, 1977 in Slavin, 1994: 174-175)

According to Slavin (1994) using Bandura's principles of modeling effectively can increase achievement. It is not only the deliberate modeling at school that will shape the behavior of the student; parents also may provide models that may shape the individual's behavior. In this connection Gardner quotes Vygotsky and others as saying:

The kinds of intelligence favored, and the models of intelligence provided, will differ from an early age, and it is highly unlikely that these differences will have no effect on the child (Cole and Cole, 1989; Rogoph and Lave, 1984; Vygotsky, 1978, in Gardner, 1993: 221).

2.7 Motivation

Constructivists take motivation to be a key component and as one of the principles of constructivist learning (Kim, 2001). According to Elliott (2000) motivation is an important psychological construct. Elliott summarizes Stipek's and others' findings and says that motivation affects learning and performance in at least four ways:

- ✚ *Motivation increases an individual's energy and activity level. It influences the extent to which an individual is likely to engage in a certain activity intensively or half-heartedly.*
- ✚ *Motivation directs an individual toward certain goals. Motivation affects choices people make and the results they find rewarding.*
- ✚ *Motivation promotes initiation of certain activities and persistence in those activities. It increases the likelihood that people will begin something on their own, persist on the face of difficulty, and resume a task after a temporary interruption.*
- ✚ *Motivation affects the learning strategies and cognitive processes an individual employ. It increases the likelihood that people will pay attention to something, study and practice it, and try to learn it in a meaningful fashion. It also increases the likelihood that they will seek help when they encounter difficulty (Stipek, 1998; Pintrich, Marx, & Boyle, 1993; Eccles & Weigfield, 1985; Dweck & Elliott, 1998 in Elliot 2000: 332)*

Thus, as a significant part of learning, motivation is emphasized in enhancing the performance of students. What motivates the student and what goes against the motivation of the student should be clearly identified to foster an effective learning

environment for the students. According to Elliott et al, (2000) some feedbacks may have devastating effect on the student's performance.

2.8 Social constructivism

Social constructivism is a theory developed by Lev Vygotsky which emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (Derry, 1999; McMahon, 1997 in Kim 2001). Our knowledge and perceptions of reality are socially constructed and we are socialized in our upbringing to share aspects of that perceived view (Berger and Luck Mann, 1966 in Kim 2001:4). "The individual in a social situation – each student in the class, influenced by peers, home, and so on – construct meaning" (Elliott, 2000: 15).

There is another perspective of constructivism called cognitive constructivism, which is based on the work of the developmental psychologist Jean Piaget's theory of cognitive development. There is a great deal of overlap between social constructivism and cognitive constructivism - both believe that the individual constructs her/his knowledge (Kim, 2001).

But, there is also a great deal that is different. The cognitive constructivists are criticized for overlooking the social construction of reality. They believe that the individual is responsible for the construction of his knowledge in her/his interaction with the environment. They don't emphasize the contribution of the society in the individual's construction of knowledge, unlike social constructivists.

Ontological Assumptions of Social Constructivism

Social constructivism is based on specific assumptions about reality, knowledge and learning. Social constructivists believe that reality is constructed through human activity. Members of a society together invent the properties of the world (Kakla, 2000, in Kim 2001:1.) For them, reality is a social product; it doesn't exist out there independently of

the human mind. Reality can't be discovered. It does not exist prior to its social invention (Kim 2001:1)

Epistemological Assumptions of Social Constructivism

Another assumption on which social constructivism is based is the theory of knowledge. To social constructivists knowledge is also a human product, and is socially and culturally constructed (Ernest, 1999; Gredler, 1997; Part and Folden, 1994 in Kim, 2001:1).

Social constructivists believe in the intersubjectivity of knowledge; that is, they believe that there is shared understanding among individuals whose interaction is based on common interests and assumptions that form the ground for their communication (Rogoff, 1990, in Kim 2001.) They say "construction of knowledge is also influenced by the intersubjectivity formed by cultural and historical factors of the community" (Gredler 1997; Prawat and Folden, 1994 in Kim 2001:1). Thus, the individual constructs his knowledge by drawing shared meaning from the context she/he is situated. "Knowledge is derived from interactions between people and their environment and resides within cultures" (Shunk, 2000; McMahon, 1997 in Kim 2001:1).

Assumptions of Social Constructivism on Learning

Social constructivists perceive learning as a social process. It doesn't take place only with in an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997 in Kim 2001:1).

The assumption of social constructivism gives due attention for both individual and the social impacts on learning. Social constructivists see as crucial both the context in which learning occurs and the social context that the learners bring to their learning environment (Kim 2001:2). It is not like cognitive constructivists, that is, it does not see

only the individual. It is not letting the individual construct his knowledge by himself; the individual needs assistance and guidance.

Unlike cognitive constructivism, the teachers in social constructivism do not just stand by and watch children explore and invent. She/he doesn't act as a knowledge source either. When the children are presented with performed concept, they will only memorize what is said about the idea (Kim, 2001). Thus, the social constructivist teacher assists the student to create understanding of her/his environment by herself/himself through interaction with her/his environment as well as with peer group.

Social constructivists argue that students can, with the help of adults or children who are more advanced, grasp concepts and ideas that they can't understand on their own (Kim, 2001). To facilitate real learning, teachers need to organize their classroom and their curriculum so that students can collaborate, interact, and raise questions of both classmates and the teacher (Kim 2001).

Thus, the social constructivist teacher is not just a spectator in the classroom letting the children explore and discover. In connection to this Kim (2001) discusses the following:

The teacher may guide students as they approach problems, may encourage them to work in group to think about issues and questions, and support them with encouragement and advice (pp 10).

That is, the teacher is a facilitator. To this end, the teacher may guide and encourage her/his students to work in groups.

Constructivists consider the environment as a very important determinant in learning. According to Vygotsky students learn through interacting with their peers, teachers, and their contextual setting (Vygotsky in Kim, 2001).

Unit Three

METHOD AND DESIGN OF THE STUDY

3.1 Introduction

This chapter consists of the research methodology, data source and data collection instruments, method of data collection, method of data analysis and research ethics.

3.2 Methodology

In a pilot study I made with my students at Ambo College, I held a focus group discussion with female students. From the discussion I learnt that the students have a lot to say about their achievements. I also came to know that they believe that the male students are better than the female students in their achievements of mathematics. They discussed many reasons for their achievements. The interview also revealed that the context in which these students are learning is very important in studying gender difference in mathematics achievement. This pilot study gave me the guidance for my choice of methodology in investigating the perspectives of the students.

I chose to use the qualitative research methodology. This is because I found that the qualitative research method allows me to see and investigate the situation in depth and from the perspectives of the participants. In fact, the choice between different methods depends up on what I am trying to find (Silverman, 2001). I want to investigate the female students' and their instructors' views on the female students' mathematics achievements.

I study it in the natural setting within which the female students are living and describe the situation through understanding the interviews of the female students, and their

mathematics instructors as well as field and class room observation. Maxwell (2005) describes qualitative research as suited among others for understanding the particular context within which the participants act and the influence that this context has on their actions.

The point of interest in here is not to measure the behavior that the people in the university in particular the target population exhibit, rather it is to understand the situation. What I want is to understand the behavior of the research participants in particular. It is to understand in-depth why they come to develop the perspectives they have.

I am trying to investigate the achievements of female students at Jimma University as perceived by the female students and their mathematics instructors, and how some factors influence the female students' self-perceptions of their achievements in the natural context they are situated.

According to Solomon (2004), a research methodology to be employed could be determined on the bases of what and how the researcher is trying to find out in relation to his/her research problem. My focus of attention is not to know the percentage of students who have this opinion or that opinion; rather, it is to examine and understand the meaning female students and their instructors attach to the female students' achievements. It is about their perspectives on females' mathematics achievement.

For such a research problem the appropriate methodology is qualitative research methodology. Merriam (1998) stresses that the concern of qualitative research is to understand the phenomenon of interest from the participants' perspectives. Thus, for the understanding of female students' perceptions of their achievements in mathematics as well as the perceptions of their mathematics instructors, the methodology that best suites is the qualitative research methodology.

I have the social constructivists' epistemological assumption of knowledge; that is, I believe that it is socially and culturally constructed. Kim (2001) clarifies that individuals create meaning through their interactions with each other and with the environment they live in.

Thus, the students and their instructors are living in a school culture, and they have a shared meaning they attach to the situation of learning mathematics in that natural setting. Thus, I am trying to understand this shared meaning among the university community. According to Merriam (1998) qualitative researchers are interested in understanding the meaning people have constructed, that is, how they make sense of their world and the experiences they have in the world.

I use the **case study strategy**. According to Yin (2003) first and most important condition for differentiating the various research strategies is to identify the type of research question being asked. I try to investigate the perceptions of female students and their mathematics instructors about achievements of female students at Jimma University, and the factors that influence female students' achievements in the natural context they are situated. I just describe my understanding of the view of students and their instructors about the achievements of female students- how they understand the issue.

Yin (2003) stresses that the situation in which case study is used is when a 'why' or a 'how' question is being asked about a contemporary set of events, over which the investigator has no control. Thus, to understand how the female students and their instructors perceive the female students' achievements in mathematics, and to understand why their achievements are what they have now as perceived by the female students and their mathematics instructors, in the natural context and natural setting they are living without controlling any of the variables and in the given time frame work, it is best to use the qualitative case study than the quantitative methodology.

More over, all the variables are equally important as long as they are well taken by the participants. My responsibility is to understand them, not to control one variable and

measure the other which actually I can't do. Merriam (1998) reveals that a case study design is employed to gain an in-depth understanding of the situation and meaning for those involved, and she emphasizes that the interest is in context rather than a specific variable. According to her, case study design is best suited in situations where interpretation in context is important.

In particular, I use the descriptive case study. According to Merriam (1998), this study is based on a detailed account of the event under study, which is aimed at presenting basic information and forms a database for future comparison. I concentrate on a single situation-the case of Jimma University- then describe and explain it taking a holistic view of the situation.

The Case of Jimma University: Jimma University is selected because I, the researcher, know many staff members of the university who can render help in facilitating the required process there. I have known the medical faculty of Jimma University, earlier before the formation of Jimma University, and currently I am a staff of Ambo College, which is part of Jimma University. Thus, I believed that I would have easy access to the required information.

I see variability in the distribution of female graduates in the various faculties of the university in the 2004 bulletin of the university. It seems very few female students are in the technology faculty where they are taking mathematics courses. So, this event together with my experience as a mathematics instructor in the university inspired my curiosity to study what drive their achievements in mathematics courses through interview. That is, I wanted to understand the perspectives of the students and their instructors about their achievements.

3.3 DATA SOURCE AND DATA COLLECTION INSTRUMENTS

The data sources are female students in the Education Faculty, Ambo College, Natural & Information Science Faculty and the Technology Faculty. I employed purposive

sampling. I selected students who are expressive and have various levels of achievements.

I briefed the mathematics instructors in the university, and then they helped me in selecting the students. Since I know the students at Ambo College when I was giving a mathematics course to them, the participants in this college are selected by me based on their expressiveness during the focus group discussion in the pilot study I held before embarking on this research.

The achievements of the research participants - their scores in the mathematics courses they have taken, their cumulative GPA, the minimum and the maximum cumulative GPA in their group- together with their departments is given in table 3 below.

Other data sources are observation I held in the classrooms, the libraries and the lecture halls. The class I observed is the second year statistics students. This class was selected because there are many female students, they were taking mathematics courses during the data collection and there are research participants from this class. I also made document analysis of sources from the departments, the registrar, and the public relation office of the university.

Table 3: Achievements of student participants relative to the batch's minimum and maximum cumulative GPA.

S.N	Name	Department	Year	Mathematics grades	her CGPA	min CGPA	max CGPA
1	Senait	Statistics	1 st	C,B,C	2.61	1.94	3.72
2	Solome	Statistics	1 st	F,C,_	1.94	1.94	3.72
3	Beletu	Biology	2 nd	A	3.80	1.96	3.95
4	Beza	Biology	2 nd	B	3.18	1.96	3.95
5	Muna	Mathematics	4 th	C,A,C,B,B,B, B,B,B,C,B,A	2.76	1.67	3.67
6	Fantu	Physics	3 rd	F,C,C,D	1.99	1.66	3.29
7	Frehwot	Physics	3 rd	C,C,C,C	2.09	1.66	3.29
8	Etafraw	Civil Engineering	2 nd	D, C, D	1.98	1.35	3.48
9	Etagegn	Electrical Engineering	4 th	A, A, A	3.52	1.94	3.84

Source: the respective departments

In fact, some of my interviewees were found by chance and were found to be irreplaceable key informants. I held the interviews with the students in the geometry laboratory of the mathematics department, where some members of the department have offices adjacent to it. While waiting for the instructors to come, I observed two students talking about grade complaint with their instructors. From their discussion, I came to learn that one of them is on the verge of dismissal. I just felt that it is good to talk to her. After having a brief conversation, I invited her for interview. She said ok.

This student whom I call **Etaferaw** is a civil engineering student. Talking to her also solved the problem of getting an engineering student. In the other session of the discussion with her, I asked her if she can contact me a high achiever engineering student. Up on her consent, she contacted me with the high achiever electrical engineering student whom I called **Etagegn**.

Thus, as can be seen in table 3, the students who are taking mathematics courses in the faculties – education, technology, natural and information sciences, and Ambo College – are selected. The other data sources are the mathematics instructors in the university. Mathematics instructors who are expressive are selected for the interview. The number of interviewees is determined by the data saturation point (Merriam, 1998). That is, if no new information is obtained from new participants to come, there is no need of interviewing additional participants.

According to Merriam (1998), the researcher is a major instrument of data collection. I take interview of my data sources-female students and mathematics instructors. Thus, for the collection of data from all these sources, I was the data collection instrument. I was sensitive and reacted to any incidence in the data collection process which I found relevant to the study. I modified the data collection process depending on the situation and convenience of the participants.

I interviewed as many students as I can, till my data saturation point was reached - a point where information begins to repeat and no new information is obtained from new participants to come. That is, the number of interviewees who participated in this study was determined by the data saturation.

I used pseudonyms for the participants. That is, the names mentioned here are not real names of the participants. Thus, the key female student informants of this study are:

1. Senait, a first year statistics student.
2. Solome, a first year statistics student.
3. Etaferaw, a second year civil engineering student.
4. Muna, a final year math student

5. Firehiwot, a third year physics student
6. Fantu, third year physics student
7. *Beletu*, second year biology student
8. *Beza*, a second year biology student
9. Etagegn is a fourth year electrical engineering student

I held focus group discussion with mathematics instructors at Ambo College. I also interviewed two mathematics instructors from Jimma main campus. The data saturation point determined the number of instructor participants in this study.

Thus, the key informants in the interview with the mathematics instructors are given pseudonyms:

1. Girma, a math instructor at Jimma main campus.
2. Alem, a math instructor at Jimma main campus.

I had informants in the field observation. The information I got from these sites through observation as well as by asking individuals at the sites is quoted as field note. Thus, the key informants about these sites are:

1. The technology library acting head
2. The library and documentation vice head
3. Gender office expert at Jimma main campus
4. A statistics instructor at Jimma main campus
5. A mathematics instructor at Jimma main campus
6. Gender office expert at Ambo College
7. The Ambo College library head

3.4 METHODS OF DATA COLLECTION

The students are interviewed by raising various semi structured open- ended questions. These students are selected from four faculties – Faculty of Technology, Faculty of Education, Faculty of Natural and Information Sciences, and Ambo College. I also interviewed mathematics instructors in the university using semi structured open-ended questions.

In the field observation I stayed in the classroom, library, and lecture hall to see how the female students are interacting at the respective places, the environment in which the students are learning and studying. I wrote every thing that I observed and found relevant to the study. Whenever I needed some clarification I asked the concerned person at the site.

I also made document analysis of the students' scores in mathematics courses. From what I got from these documents, I raised some questions to the students as well as to their instructors when I saw that it is relevant.

3.5 Method of Data Analysis

Merriam (1998) reveals that in qualitative research the researcher is a primary instrument for data collection and analysis. I tried to understand participants' perspectives, and interpreted it. I didn't use any software or other persons for neither data collection nor for interpretation. According to Janesick (2000) this is the critical difference between the two research paradigms - qualitative research and quantitative research. Janesick further describes qualitative research as requiring "a powerful use of the researcher's own mind and body in analysis and interpretation of the data. ... No one can interpret your data but you" (Janesick, 2000: 390). Thus, the method of analysis I employ is direct interpretation of the participants' words in their interview - called narrative analysis (Merriam, 1998). The participants' accounts of experience form the narrative text of qualitative research approach.

The text is analyzed using social constructivists' perspectives of knowledge construction. That is, in understanding the meaning of the interviews of the participants, and the field observation, I tried to understand both the context of Jimma University as well as the individual's meaning, which she/he has acquired in her/his individual life.

Social constructivists' perspectives of knowledge construction give emphasis for both the individual as well as the social context in which the individual is operating. It emphasizes the importance of culture and context in understanding what occurs in a society and constructing knowledge based on this understanding (Derry and McMahon in Kim, 2001).

Thus, I tried to interpret words to understand the context and culture of the university as well as the individual's perspective. I tried to understand the shared meaning among the university society about the phenomenon - about gender difference in the achievements of mathematics at the university, which the university community constructed.

According to Schwandt (2000), we don't discover knowledge rather we construct or make it, which we continually modify in the light of new experience (pp: 197). I am not going to discover knowledge that already exists; rather, I try to construct my knowledge of the situation in that particular time frame, and particular setting. This knowledge could be modified or may be obsolete outside that time framework and that setting. After all, the participants may turn out to have a different meaning on the same issue in a different setting and time frame.

The student in a class influenced by peers, home, and so on constructs meaning (Elliott et al, 2000). The analysis is based on understanding of the shared meaning among the members of the university community, particularly the female students and their instructors on the achievements of female students and on the factors affecting their achievements of math. That is, I try to understand the meaning these people have constructed about the learning situation at the university especially in relation to females' mathematics achievements.

Merriam (1998) stresses that in qualitative research data collection and data analysis are simultaneous activities. I began interpreting the data on the first day of collection. As I analyzed the data new questions came to my mind. Then, I went to the data sources at Jimma University and looked for clarification.

According to Merriam (1998) the most basic presentation in a study's finding is a descriptive account that requires thinking through what will be included and what will be left out as well as compressing and linking data together in a narrative that conveys the meaning the researcher has derived from studying the phenomenon.

Thus, for further in-depth understanding, I categorized the data from each source - interview of female students and interview of their mathematics instructors- in two different lists. I form categories by careful and repeated listening of the interview of female students, until I can see that there are themes into which each of the data can be categorized; that is, I put recurring themes in one category, and so on. I do the same thing for the interviews of the mathematics instructors in a separate list. Then, I continue the interpretation using the social constructivists' perspective of knowledge construction.

As to Merriam (1998) construction of categories is not a simple task; it is an intuitive process, which needs a clearly articulated purpose of the study and unit of data. Any meaningful (or potentially meaningful) data segment is called a unit of data (Merriam, 1998). Then, I compare these units of data with each other to see recurring regularities in the data and assign these data in mutually exclusive categories having the same level of abstraction (Merriam, 1998).

Finally, I merged the two lists, with the similar categories put in one. Subsequent items were sorted in these categories, exhaustively. I named these categories by the terms or concepts that reflect what I saw in the data. The categories I formed are answers to the research questions; they reflect the purpose of the study (Merriam, 1998).

Accordingly, I have two main categories:

- ↓ Studying mathematics is not paying and
- ↓ Contradiction between Females' Mathematics Learning and Socio-Cultural Factors

Under the second category there are four sub-categories:

- ↓ Freedom for Interaction,
- ↓ The learning Environment is not Meant for Females' Mathematics Learning,
- ↓ I don't have Role model, and
- ↓ The Female is a Guest in Mathematics Class.

Following the categorization of the data under the respective themes, I went on describing each through direct interpretation.

Triangulation: validity is an issue that quantitative researchers usually question about qualitative research. Though data interpretation is subjective, a careful investigation and interpretation of data from different sources has enabled me to triangulate my data.

According to Stake (2000), for qualitative case study **triangulation** is considered as "a process of using multiple perceptions to clarify meaning, verifying the repeatability of an observation or an interpretation" (pp: 443). Thus, I used multiple data sources to ensure more understanding, and as indicator of research quality. That is, I employed data triangulation using different data sources: data from interviews of female students and data from interviews of their mathematics instructors, as well as data from field observation.

As to **generalizability** of my findings in this research to other settings, I provide a thick enough description of the context so that readers will be able to determine how closely their situations match the research situation and whether findings can be transferred (Merriam, 1998).

3.6 Research Ethics

- I asked permission to record the interview my partner delivers.
- I explained everything that my partner asks about the research.
- I tried to fit to the interviewees' schedule not to my own.
- I respected their right not to cooperate for the interview fully in answering the questions in the discussion.
- I didn't mention the names of my partners.
- I did not ask questions which are too personal.
- I didn't interfere in their rights to boycott the interview.

Unit four

DATA PRESENTATION AND DATA ANALYSIS

4.1 The Context of Jimma University

Jimma University has eleven faculties – Ambo College, Jimma College of Agriculture Veterinary Medicine, Faculty of Law, Faculty of Education, Faculty of Medical Sciences, Faculty of Public Health, Faculty of Technology, Faculty of Social Science and Humanities, Faculty of Natural and Information Sciences, School of Graduate Studies.

The number of libraries is not proportional to the number of faculties. According to Jimma (2006) there are only seven libraries under the library and documentation service - Ambo College Library, Jimma College of Agriculture Library, Law Library, Education Library, Health Sciences Library, Technology Library, and Social Sciences Library. The library and documentation service has a total area of 2268 m² / 6120 (Jimma university, 2006). According to the vice head of the library and documentation service of the university, this figure includes only the main campus libraries; that is, excluding the Jimma College of Agriculture library and the Ambo College library.

The Ambo College library head indicated that the Ambo College library has the capacity of about 1500 persons per day. He said:

The library is serving beyond its capacity. It is very crowded. Sometimes students sit three in two seats. ... I have never observed females sitting like that. During the opening of the library, males rush in to the library to take books pushing one another; but females don't do that."
(Field note, February 2007)

In a situation where there is scarcity of resources the female students are affected because they can't do what the males do. This may be because of their physical strength. Another reason could be the socialization they were brought up.

In the Technology Library of the main campus in one afternoon and one night I observed that many students were studying at the circulation desk, even leaning on the wall, and waiting for free seats (Field note, January, 2007).

The acting head of the Technology Library confirmed that this is always the case during this time only, *"It is only in the first semester of the academic year that the library is crowded; especially in the morning it will not be crowded"*.

The undergraduate students in the main campus; that is, those from the eight faculties - the faculties of education, technology, law, medical sciences, public health, social sciences and humanities, natural and information sciences, business and economic are allowed to share the five libraries in this campus, according to technology library head (field note, January, 2007).

These libraries are meant for 16,052 regular and 4,906 evening students in the continuing education program (Jimma University, 2006). I observed that the education and the technology libraries don't have ventilators. In one very hot after noon, I witnessed that students were trying to ventilate themselves using a piece of paper and their exercise books (field note, January, 2007)

The head of the technology library confirms that there are incidences of harassments in the library. This is apparent when he says:

We have the information about incidences of harassments in the library, but no formal report has ever been made to our office. ... The students are informed of reporting such harassments to the offices, but barely any case has ever been reported to the offices.

A similar explanation is given by Ambo College library head about harassments in the library. This is apparent when he says:

...Females' harassments are observed in the library, but no female student has ever reported. ...a male student was seen drunk and was trying to force a female student to leave the library and talk to him. A library attendant who observed the situation brought the case to me. When I asked the female student what happened, she denied of any harassment he did to her. I took along time to convince her. ... She was not willing because she was afraid of the revenge he might take. Finally, she told me that it was not the first time that he was disturbing her and that he had been bothering her to be his girlfriend. Then, I called him and advised him. ... I am a member of the discipline committee for students, and I know that there are no codes of harassment in the college.

The female students may not report cases of harassment. Even I learnt that they might hide when asked of real incidences because of fear of revenge. It seems they want to resolve attacks against them peacefully instead of reporting the case. I understand that some female students have feeling of insecurity.

According to the associate registrar, there are about 136 lecture halls in the main campus. I observed that these classrooms serve as reading rooms. The total population of students is 22,243, among which 16,052 are in the regular program and 6,191 are in the continuing education program that is in the evening only (excluding the summer in-service which involves 2,323 students increasing the grand total to 24,566) (Jimma University 2006).

I observed that the female students in the main campus of the university use the lecture halls as reading rooms, both in the daytime as well as during the night. When the female students study in the lecture halls, they are many in number (field note, January, 2007). It seems that they are in group for the sake of security, that is, to avoid risks of any attack.

The gender office of the university is accountable to the president. According to the expert of the gender office, it was established in 1997. The expert says:

It was running as a committee from 1987 to 1997 E.C. comprising representatives of female workers, the registrar, and the student dean. As of 1997 it has been working under the president's office. All its workers are females. It is still under formation. ...there are no rules and regulations on harassment. Actions which are labeled as harassment are not clearly identified by the office. ...Though we have the information about females being harassed in the university - in the lecture halls as well as in the library - we didn't as such come across serious violation of females' rights. The office has demanded officials for few lecture halls to be used by females only to avoid harassments by some male students in the lecture halls. But, we didn't get positive response because of lack of rooms.

The gender office of Ambo College is accountable to the dean of the college. An expert in this office also confirmed that there are no separate codes for harassment. This apparent when she says:

There are no codes of harassments other than the disciplinary codes of the college. ...There are incidences of harassments in the college, but the female students who witnessed the incidence deny of what they observed. Thus, we face problem in taking measures against this act. Many of the lecture halls are open for all students, but six are reserved for females only to avoid disturbance by some male colleagues. (Field note, February 2007).

According to the registrar there are 31 lecture halls in Ambo College. I observed that students use these lecture halls as reading rooms. The females are seen in groups. I did not see any female student alone in the absence of other female student in the hall (field note January 2007).

The staff profile of the university indicates that there are very few female academic staff members (Look at table 4)

Table 4: the staff profile of Jimma University in 2005/2006 academic year.

S. No	Staff	Male	Female	Total
1	Academic staff	807	55	862
2	Health professionals	125	82	207
3	Administrative staff	580	485	1069
Grand Total		1512	622	2138

Source: Jimma University, 2006

The staff profile indicates that there are very few female instructors in the university. This has message for female students in the university. It may indicate that females are not meant for academic success. On the contrary table 4 shows that the statistics is better in the health professionals - 82 females and 125 males. It is even better in administrative staff – 485 females and 580 males.

The large number of female administrative staff members includes the secretaries, cleaners, and other lower level office workers. I believe that this may have another message to the female students. It may indicate that the females are best suited to such positions. It may discourage their endeavor for better achievements especially in areas which they perceive are difficult to succeed, because they see very few high achievers in the university. According to Schunk, (2000 in Woolfolk 2004) observation of similar models induces a feeling that ‘if they can do it I can too’.

Table 5: The academic staff profile of the participants' departments.

S N	department	faculty	female	male	total
1	Mathematics	Education	0	11	11
2	Physics	Education	0	12	12
3	Statistics	Natural & Information Science	1	4	5
4	Civil Engineering	Technology	0	9	9
5	Electrical Engineering	Technology	2	11	13
6	Biology	Ambo college	1	16	17

Source: the respective departments

Table 5 shows the staff profile of the academic staff members of each department. There are no female staff members in the physics, mathematics as well as civil engineering departments. Though the impact of having female teacher/instructor on the females' learning is not known as far as my knowledge is concerned, I believe that it also contributes to the hindrance of some females' interactions with their instructors. They may see the offices of the instructors as being masculine. It also affects the female students' motivation in that there are no similar people who could be models for them.

Table 6: The number of students in the participants' batch by department.

S. N	Year	Department	Faculty	Female	Male	Total
1	4 th	Mathematics	Education	8	119	127
2	3 rd	Physics	Education	8	84	92
3	2 nd	Statistics	Natural & Information Science	13	41	54
4	2 nd	Civil Engineering	Technology	14	77	91
5	4 th	Electrical Engineering	Technology	7	50	57
6	3 rd	Biology	Ambo college	55	62	117

Source: Jimma University office of the registrar, and Ambo College registrar.

The female students are minorities in their respective classes almost in all departments. A better gender disparity is observed in the biology department (table 6). If a male student wants to group himself with males he has a better option. If he wants to discuss questions with colleagues in his dormitory he has many immediate references. But, for the female who wants to group herself with females, she has few options. She has few immediate references in the dormitory.

In general the university seems male dominated. According to the public relation expert of the university, among about 26 senate members of the university the only female member is the gender office director, and among about 61 department heads only 3 are females (field note January, 2007). In the case of Ambo College, the entire department and section heads as well as the deans of the college are males.

Having this context of Jimma University in mind, I have described the interviews of the female students and their mathematics instructors as well as my field observations of classroom, library, and lecture hall.

It is presented in two sections: Studying Mathematics is not Paying; and

Contradiction between Females' Mathematics Learning and Socio-Cultural Factors. The second section has four subsections: Freedom for Interaction, The learning Environment is not Meant for Females' mathematics Learning, I Don't Have Role Model, and The Female is a Guest in Mathematics Class.

4.2 Studying Mathematics is Not Paying

According to social constructivists motivation is a key component of learning (Kim, 2001). In order to learn some thing the individual needs to have the drive. Absence of motivation makes learning difficult. When a student is not motivated to learn, a key element of her/his learning is missing. Thus, lack of motivation may hamper learning.

Motivation increases the likelihood that people will pay attention to something, study and practice it, and try to learn it in a meaningful fashion. It also increases the likelihood that they will seek help when they encounter difficulty. ... Motivation affects choices people make and the results they find rewarding (Elliott et al, 2000:332).

Thus, motivation affects the degree to which an individual may be committed to choose and perform a certain task. If a student is not motivated to be engaged in a certain task, she/he may be frustrated in the face of difficulty, rather than seeking help (Bandura in Woolfolk, 2004).

Under this category, I described how the female students perceive the subject mathematics in relation to the effort that they exert in doing mathematics, and the result they are scoring. I also described how the mathematics instructors perceive the female students' achievements of mathematics.

Some students tend to focus on subjects/courses in which, they think, they can easily be successful. They take mathematics as time taking and difficult to succeed in. Hence, they

are not motivated to do mathematics. They tend to study other subjects/courses which they assume require lesser time and are easy to succeed in. **Senait's** story reveals this fact when she says:

I like mathematics than any other subject. ... It takes me much time in studying, but I don't score good results in the exams. Thus, I tend to study other subjects, which involve reading (Shimdeda). I score good results in these subjects, and they don't take me much time to study (Senait, 2006).

According to her, she has the interest to do mathematics, but she is not motivated to do it. She faces one obstacle in doing it - the amount of effort she exerts to be successful in the subject is not proportional to the result she earns. She found out that the result in the exams is poor. So, she convinced herself that studying mathematics is not rewarding. Allocating smaller time for other subjects will bring the required success. Thus, she feels 'why all these bother in studying mathematics' and turns her face to other subjects.

She describes mathematics as something, which requires two things-memorizing concept and memorizing procedures. This is apparent when she says:

In mathematics, I should remember the concept and should not miss any step while in other subjects, like biology, it is only remembering the concept. ... But, I see that males are good at mathematics (Senait 2006).

She assumes that mathematics has many requirements to succeed. Studying mathematics is a difficult task for her. She feels that her mathematics achievement is poor as compared to the achievements of the male students.

Some participants perceive mathematics as requiring group work and previous experience in doing it. The following excerpt from **Solome's** story tells this fact:

Mathematics takes me much time both to study as well as in exams. It may be because I did not have the experience in

doing it. When I try to do it in a short cut method, I commit mistakes. I can do it, but I will not be successful in exams. I don't know why? ... Mathematics takes longer time to study. ...It needs group work (Solome, 2006).

For Solome, mathematics is time taking and susceptible to mistakes. She forwards lack of experience as one reason for not doing mathematics in a short time. She perceives mathematics as requiring experience. Thus, she doesn't want to take time to study it. She also understands mathematics as some thing which can be learned through group work and that mathematics is learnt through interaction. She adds her female colleagues' experiences:

There were many female students who were good at mathematics in my high school. Still, the majority of the students who were working well on mathematics were males. This is because, mathematics takes much time to study and the female students are busy with household tasks, especially in the rural areas (Solome, 2006).

She believes that she is not the only one. Her colleagues, who were able to do mathematics, were forced to abandon mathematics and focus on other subjects that they assumed don't take as much time as mathematics because of lack of enough time. She mentions her experience in another subject:

In 11th grade chemistry was more difficult for me than any other subject. In grade 12, I studied very hard even in the summer. Finally, I was improving - I became good at it. ... I used to wish to be a laboratory technician. I still have the plan to study laboratory technology. I like English also because it is an international language (Solome, 2006).

In spite of the difficulty to understand, as well as, the very much time it required her, she tried very hard to be successful in chemistry. Finally, she made it. I understand that she should see something tangible in order to enjoy a subject or a course. That determines her like or dislike for a course. Or she has to see some importance in it. So, she believes English is important for her, as it is an international language. I see her

improvement in chemistry as another example in seeing importance as a motivation for her like or dislike of a course.

She takes mathematics as lengthy procedure and she tries to have a short cut procedure. At the same time, she feels that it is something she can do. But she perceives it as time consuming. She feels that it is difficult to study it independently and that it requires her to study in groups. I understand that the many requirements she has perceived, to be successful in mathematics has affected her motivation to study it.

Others perceive mathematics as requiring patience. An excerpt from **Etaferaw's** story indicates this fact:

I treat all courses equally, but I like mathematics and biology. ...I don't have the patience to study mathematics for long time. ...Females lack patience to do calculations for a long time, but in reading they are good. For example, I am like that. I score good result in subjects, which involve reading. ... You see that there is large number of female students in health faculty. Where as, in the technology faculty, they are small in number (Etaferaw, 2006).

According to her she doesn't make any discrimination between subjects. But, mathematics has been a tiresome job, which needs patience that females lack and males possess. She believes that mathematics is a male domain. Even though she likes it, studying mathematics is not paying for her. According to Kim (2001) she has a shared meaning about her achievement in mathematics that she constructed in living with the society and from what she observed; as the individual constructs his knowledge through interaction with the environment in the social context she is situated.

Some female students at Jimma University perceive mathematics as some thing difficult to sustain high achievement. This apparent from the story of **Muna**:

t all depends up on your work; if you work hard you score. If you don't work hard your score will be less. That is how I see it. In the semesters I worked harder my score has been

good. But in those semesters in which I didn't work hard, my score has been poor. ...Most of the female students who had been working hard, and used to perform better than the male students in the previous grade levels - in grades 6, 7, 8 and 9, fell down in the national exam. I don't know why? Only one succeeded (Muna, 2006).

She believes that the basis of success in mathematics is hard work, that is, for her as well mathematics needs hard work. She observed that those female students who were hard working fell down in the national exam. She shares the notion that females are not paid for their endeavor.

Her experience in high school had shown her that except for very few, the majority of female students do not sustain their good results. Even though she is a hard working student, she feels that she is not consistent in her achievements.

Some consider mathematics as requiring concentration and interruption while studying as having a devastating effect. An excerpt from **Beletu's** story confirms this fact:

I give more time to mathematics in both high school as well as in the university, because, my home tutor used to tell me that it is important to give more time to mathematics and English. ... I believe that mathematics needs concentration and continuity. If you are interrupted or distracted while studying mathematics, you may need to repeat the whole procedure again in which case you may be discouraged. This may be true in other fields, too, but to a lesser degree (Beletu, 2006).

She perceives mathematics as requiring more time. She feels that she is performing well in mathematics, and she gives the credit to her mathematics tutor. She gives more time for mathematics because she was told and was convinced that it needs more time. She also believes that mathematics needs concentration. She believes that she may get lost once interrupted, resulting in being discouraged if her attention is repeatedly distracted.

Some construct mathematics as something imaginary and requiring strong base in practicing it. They take it as something difficult to understand. Dealing with it has some pain. **Beza's** story confirms this fact:

I like biology. I prefer reading with understanding to calculation. ... I get bored to do mathematics. I don't complete it till the last step both in exams and while studying...mathematics needs longer time and experience in practice. It needs a stronger base than any other subject. It is a difficult subject. It is imaginary and abstract. But, biology is not like that, it is something you can see (Beza, 2006).

Her favorite subject is biology and she believes that it is understandable. She is not as interested in mathematics. She believes that she lacks the patience which mathematics requires. She perceives mathematics as abstract, and time taking. So, she feels that one has to have the patience to bother his imaginations to do mathematics. While in biology it is some thing that one sees. It is not abstract. According to her mathematics is boring and difficult.

For some, mathematics requires encouragement and interest. The following excerpt from the story of **Etagegn** reveals this fact:

Mathematics needs encouragement and interest. When I was in high school, I had a class mate who used to give problems to do at home. When he sees that I did it correctly, he used to encourage me. Thus, I persisted in doing mathematics. I believe that such encouragement is very important in learning and achieving in mathematics (Etagegn, 2006)

According to her the encouragement she used to enjoy during high school from her colleague has played great role in her mathematics career. Had this encouragement came from her teachers would it be more significant? I believe so.

Some mathematics instructors perceive that the female students are in general poor at mathematics as compared to the male students. This is apparent from the following excerpt of **Girma's** story:

There are very few female high achievers in mathematics. Out of the twenty mathematics classes I taught in the university, there was only one female who scored an 'A'; and she was on the border. ...The female students lack base and confidence (Girma, 2006)

He perceives female students as lacking base and confidence in learning mathematics. He means that lack of experience and base is hindering their mathematics performance in the university.

Other mathematics instructors believe that female students perceive mathematics as a difficult subject. The following excerpt from the story of **Alem** explains this fact:

The students need to take mathematics as any other skill. Mathematical skill is developed through exercise. I usually observe that the female students take it as very tough. That I believe is one reason why their achievement is poor (Alem, 2006).

According to him, they consider mathematics as huge burden; leaving it out there at a distance instead of taking it as something to be learned as a skill. He believes that the assumption that the students have towards mathematics itself is a reason for poor achievement. It may affect their performance on the subject.

Some instructors perceive mathematics as requiring much time and hard work. The following excerpt from the focus group discussion with Ambo College mathematics instructors is indicative of this idea:

Mathematics needs hard work and longer time of studying. ...Mathematics is more abstract and needs analysis. Actually those students who came from families with good

academic background perform well in mathematics (focus group discussion with mathematics instructors, 2006).

The tenet that mathematics is more abstract seems to be shared by these instructors. They also perceive it as taking much time and hard work, as did the female students.

Thus, mathematics is perceived by female students as being different from other subjects in that it needs concentration, imagination, very much time, and no interruption while working on it, encouragement, a strong base, experience, group work, interest, patience and strength. It is also perceived as boring, full of lengthy procedures, abstract, and having two fold natures – remembering concepts and remembering steps.

Some mathematics instructors perceive their female students' mathematics performance as being poor because of poor background in the subject - lack of base and experience-lack of confidence; and because of their perception that mathematics is a tough subject. The instructors consider mathematics as time taking and requiring hard work on the contrary some of the female students don't have enough time (Cf focus group discussion in section 4.3.2) , and they feel that it is abstract. Thus, some mathematics instructors and some female students at Jimma University perceive that studying mathematics is not paying for females.

No matter what actually mathematics requires, it is important that we examined and understood the perception that the female students and their mathematics instructors have towards the female students' achievements in mathematics. How some factors influence the female students to have these perceptions towards their mathematics achievements?

4.3 Contradiction between Females' Mathematics Learning and Socio-Cultural Factors

The female student participants have the perception that mathematics is different from other subjects in many respects that made it a difficult subject. These perceptions might have influenced their achievements in mathematics. Are there factors that made them have these perceptions on mathematics and their mathematics achievements?

4.3.1 Freedom for Interaction

According to Kim (2001) Knowledge is constructed through the interaction among people and with their environment; and in learning mathematics, students need to interact among themselves and with their teachers/instructors. Accordingly, there need to be the freedom to interact with colleagues as well as with the instructors/teachers.

In this section I try to describe the extent to which the situations the female student has been in, allowed her to interact with colleagues, teachers and instructors in the institutions she has been learning.

Some female students are denied of the freedom for interaction by their parents since their school days, which may have a repercussion on their perception on the mathematics learning in the university. This is apparent from the following excerpt of Senait's story when she says:

My father does not like me to spend time with friends for group study. He does not want to let me out, except during school time. ...I want to study with male colleagues in our class, but I don't do 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/instructors. Whenever I have question, I tend to ask female colleagues. ... I feel comfortable to ask female teachers (Senait, 2006).

She is deprived of free interaction with colleagues, except during school time. She has to accord to what her father tells her. She requires interaction in doing mathematics. But, she might inhibit herself from learning through group interaction because she knows it is a forbidden act for females except at school time; it is an act which has a negative repercussion as well. It might become a hindrance in her interaction in the university.

She doesn't interact with male mathematics teachers and she believes that she could have interacted well with female mathematics teachers/instructors which she doesn't have. According to her if she has a female mathematics teachers with whom she could have interacted well; she could ask the question she has with out discomfort than be anxious about what will follow when she asks male colleagues. She has banned herself against asking males – teachers or colleagues. A proportionate number of female and male teachers/instructors could have eased her anxiety of interacting with male teachers.

Some consider that there is variability in the freedom of interaction among female students from ruler areas and those in the towns. **Solome** has a story which is an indicative of this fact:

Female students were not asking male colleagues and their teachers because they are afraid. This is more prevalent in the rural areas. ... I discuss with both male and female students. But, when I was in the countryside, I was afraid to be with males, for fear rumors may go about me (Solome, 2006).

According to her, there is difference between a female in the cities and a female in the rural areas in their freedom to interact with male colleagues - the females in the rural areas are more fearful.

Though the fact that females lack or are denied of their freedom of interaction with their male colleagues and teachers/instructors by parents and male colleagues may not be the same everywhere in its extent and type, the prevalence is still there. An excerpt of Etaferaw's story shows this fact:

I was learning both primary school as well as high school in a private school in Addis. I used to study with both male and female students at school, but at home, I study with females. But, my father is not happy when my friends come home, for fear I, in return, go to their homes. I never ask my teachers/instructors. While I was in high school, I tend to ask my friend who is my neighbor too. She was better than any of the male students in our class. I had also a home tutor. I used to ask him when I have question (Etaferaw, 2006).

This student's interaction is better - she could study with male students at school. Still she kept her doubts till she found a way of asking her friend or her tutor, instead of asking her teacher on the spot. She was not having the freedom to study with colleagues at her home. Thus, her interaction with colleagues was partially hampered, and her interaction with teachers was totally hampered.

We can see how the freedom one has been enjoying in studying and interacting up on one's will with out restriction and interference would mean in Muna's story:

I was in the rural area with my parents, and then I came to Addis when I joined high school. In Addis I was living with my eldest sister. Both my parents and my sister had never forbidden me to study with boys as well as with girls. ...I can ask both male and female teachers. Things get clear when I discuss with any one whom I am closer. In my family there is no problem in studying with male colleagues or female colleagues no body interferes. ...Still, there are very few who think that we are getting special support and treatment from our instructors (Muna, 2006).

According to her, she was given the full freedom to interact with colleagues both in the school as well as out side the school, even in her home. This was a great

advantage for her in that she didn't develop any to interact with male colleagues. She does not look gender sensitive. I understood that this is because she never experienced any thing that is related to her gender. The socialization she experienced, particularly in the family, didn't orient her in such a way that she would be reserved from interacting freely with colleagues and teachers - be it a female or a male.

The unassertiveness of females hinders the interaction among themselves. **Firehiwot's** story explains this fact:

I discuss with both male and female students. When I have question I tend to ask male students, because they are confident in explaining things. The female students are shy and afraid. They lack confidence to explain things. ... In case of teachers, I prefer to ask female teachers to male teachers, because I can freely discuss my doubts (Firehiwot, 2006).

She prefers to ask male colleagues as the females lack confidence. It is not because of lack of knowledge, but because the female is shy, frightened and not assertive, which the female developed in the socialization she passed through. She is comfortable to ask female teacher than the male. She feels that she can best interact with female teachers/instructors than teachers/instructors. And the number of female colleagues is very small in the department, who actually are shy and lack confidence in explaining things.

Thus, I believe that the absence of a proportionate number of female colleague students as well as female mathematics teachers/instructors might be one way in which the interaction needed for mathematics learning is hampered for some female students.

Teachers need to know the psychological make up of female students. Some female students may fail to interact because of previous experience of a devastating feedback by their teachers/instructors for their failure in the subject. The following excerpt from the story of **Fantu** is an exemplar of this fact:

I never ask my teachers/instructors....I was poor at mathematics since elementary. My teachers used to be angry with me. Then, I more and more hated the subject (Fantu, 2006).

Fantu couldn't interact with her mathematics teachers because she knew that they are angry with her for she had a poor result in the subject. As a result she more and more hated the subject. Her story tells that her teachers first hampered her freedom for interaction in that they induced in her the feeling that a poor achiever is outcasted from membership of the classroom. As she achieved poor marks in exams, her teachers used to get angry with her. This led her to more hatred towards mathematics. This could be an exemplar of the role of the teacher in affecting the females' perception on mathematics.

A proper utilization of the freedom one has in the school as well as in the family may best be indicated by **Beletu**. This is apparent when she says:

I used to study in-group with females including a boy in our vicinity. ... We usually study in our house because it was closer to all members of the group. ... I don't have any problem in asking teachers - both male and female. ...I have the tendency to ask my teachers out side the classroom. I don't ask in class. May be because, nobody in our class did that when we were in high school. I still tend to ask outside the class (Beletu, 2006).

It seems that she has enjoyed the freedom in interacting with male colleagues. She has been in a good atmosphere and orientation to interact with her teachers and instructors. She does not still ask in class it seems that she has taken it as a taboo as she was observing that nobody was asking in class during her high school academic life. Customs ones developed in high school or in elementary school may continue to interfere in the academic life of the student. She gives the credit of her orientation of the freedom for interaction to her mother.

Some instructors believe that female students are not willing to come to instructors' offices. This is apparent from the following excerpt of the focus group discussion with mathematics instructors:

We usually tell our students to come to our offices whenever they have question. But, almost no female student comes here. It may be because they don't have interest in the subject. They don't even ask in class. It may be because their background and cultural influence (focus group discussion with mathematics instructors, 2006).

These instructors believe that the female students lack freedom for interacting with their instructors which they needed for mathematics learning.

Some instructors believe that the female students fail to interact in class could be resolved if they are seen as different from the male students. This is apparent from the following excerpt of the mathematics instructor in my field observation of classroom:

Females are not interacting with their instructors. I treat them equally and in the same way as I treat the male students. I don't see them as different from the male students. I challenge them in the same way as I did to male students. I believe that this is a better way to encourage their interaction in class as well as outside the classroom (field note, 2007).

Encouraging females' interaction in mathematics class is very important. It seems that this instructor has given due emphasis for females' classroom interaction. It is at the same time important to take care of their feeling so that the environment would not be frustrating. I believe that it needs study and appropriate action accordingly.

In the statistics class I observed, a female student was hesitant to complain about her score in the mid exam. She was sitting in front of me around the right middle behind all the female students. Many students went to the teacher for complaint. Then, she

followed the same suit, but she was staying a bit away. The teacher ordered them to sit. She was the first to sit; she sat on the front line. Again many students came from the back and surrounded the instructor. She again went to him. After standing for few minutes, she got the chance to ask her instructor.

At the end of the class, I requested her for discussion. Up on her agreement, I described her action in the classroom to her and asked her what was running in her mind. She said, "I was not sure if my complaint is appropriate. I didn't know whether what I did on the exam was right or wrong. That is why I hesitated to ask" (field note, January 2007).

The instructor is there to explain and clear her doubts. She lacks the freedom for interaction. I understand that to her a student can ask only when she is sure about it. This I think is a strong hindrance in learning. It has to be a first step in education to liberate the student from any obstruction of her freedom to interact with her colleagues as well as with the instructor.

Mathematics learning needs free interaction among students as well as with their teachers or instructors. It seems that absence of proportionate number of students as well as mathematics teachers/instructors in the school/university environment might produce anxiety in the female student not to interact freely. I believe that absence of proper orientation for students/instructors on gender issues might also hamper the female students' freedom for interaction which requires for learning mathematics. Ultimately, this might lead the female student to believe that mathematics learning is beyond her reach.

4.3.2 The Learning Environment is not Meant for Females' Mathematics Learning

"No intelligence or ability will unfold until or unless, it is given the appropriate model environment" (Jensen, 2000: 5). Thus, intelligences are realized depending on the availability of a conducive environment. In the absence of favorable environments,

intelligences may be left as unrealized potentials. Social Constructivists see the learning environment as very important factor, which needs to be not frustrating (Kim, 2001).

Here, I try to describe the situation in which the female student is trying to pull through in her academic career in general and in mathematics, in particular. This includes the situation in the academic institutions, in the family, in the society that could affect her academic career in general and mathematics learning, in particular.

Some mathematics instructors believe that learning mathematics can be held in a peaceful environment only. The following excerpt from a focus group discussion with mathematics instructors at Ambo College of Jimma University explains this fact:

Every body disturbs a female – her parents, her brothers, and male colleagues, even some of her teachers. ...You cannot study mathematics, at the same time thinking about what happened against you. You may read other subjects (focus group discussion with mathematics instructors, 2006).

What they mean is the learning environment is not favorable for females. When something bad happens against the female, it is not only the incidence that obstructs her learning but it may stay in her mind to obstruct her concentration. They explain how all the above parties obstruct the female's learning:

If a father sees his son, he asks why he is not studying. While in the case of his daughter, he asks why she doesn't help her mother. ...She can't sit amidst male students in the library. The male students seem to have full right to disturb the female, be it in the library, or elsewhere both in high school as well as in the university (focus group discussion with mathematics instructors, 2006).

In a situation where the natural setting of the learning environment is not meant for female's learning, it is difficult to succeed. In a situation where she is not welcome by male colleagues as a student, by parents it may be difficult to succeed. According to this

focus group discussion, in such a situation it is particularly impossible to study and succeed in mathematics. It may be true for other subjects that concentration is required, but the very assumption of the instructors' that it is different from other subjects in that it requires special concentration, may communicate an exaggerated assumption to the student.

The fact that the learning environment is not conducive for females learning is shared by some female students. The following excerpt from story of **Senait** strengthens this fact:

One night, when we were going to the lecture hall to study, a group of male students were following us. They were trying to talk to us, we ignored them and then we went to the library. Still they were following us. We were angry and we went back to dormitory with out studying. In the dormitory we are too many and it is difficult to study (Senait, 2006).

Senait feels that mathematics needs much time (Cf Senait in section 4.2). These male students are taking much of their study time. Male students are attacking them by denying their privacy to work freely. It seems that these male students feel that it is an obligation of the female to stop, at least for a moment, and talk to them. Otherwise, she has to suffer the consequence – return back to dormitory without studying. She did not react in any way except to retreat. It seems she is convinced that there is no control for the actions of the male against her.

In my field observation, among the 12 lecture halls I observed, in 10 of them I have seen females studying in the lecture halls. In all cases the females were in group. No female student was alone in a lecture hall (field note, January 2007). Though I didn't have access to ask these students in the lecture halls, I had the impression that it might be a way of keeping their security. It is not only the incidence that affects the females' learning the repercussion may be a feeling that the requirements needed for mathematics learning is denied as she assumes that mathematics requires much time, concentration, strength, etc.

The attack may not be physical. It may be word attack, which the female student may not forget. This is apparent from the following excerpt of **Senait**, "*We were in a queue for registration, and I heard the male students saying, 'This affirmative action is bothering us'.*" (Senait, 2006).

Whether she came by achieving the standard pass mark or not, it is the same for some male students; she is a female - a beneficiary of the affirmative action. This male student considers them as obstacles in his way while they did not come through the normal route as he did. Some male students have the opinion that a female learning is some thing useless. This is apparent from the following story of **Senait**:

I also remember in high school males saying 'Yet Litdershi New' ('Do you think you would be successful?' with understood Amharic meaning that a female can't be successful through her own effort) (Senait, 2006).

For him males' struggle is to achieve a certain goal. They have destiny. But, females' struggle is in vain.

Some female students take the affirmative action as one reason for some male colleagues' perceptions that females can't do. The story of **Muna** confirms this fact:

Our male colleagues in our department are now changing their attitudes as they see, through time, that the females are equally competing with them. Still, there are very few who think that we are getting special support and treatment from our instructors because of the affirmative action (Muna, 2006)

Though, improvements are seen in the males' attitudes, in general the females' achievements are not welcome by some male colleagues. Success in academic career is seen by some male colleagues as unnatural of females. Muna feels that the affirmative action has a negative repercussion on females' learning in that the credit of the female's achievement does not go to her but to the teachers/instructors help. She means that every

time the female achieves, some male students perceive that it is as a result of the instructors' special support for her not through her endeavors.

Some instructors also believe that the affirmative action is playing against the confidences of the female students. This is apparent from **Girma's** story:

The female students learn from their parents that mathematics is not meant for females. ...I believe that the affirmative action has a negative repercussion on their confidence. It induced the feeling among the female students that they are not capable (Girma, 2006).

He believes that they are socialized by their parents that they are not meant for performing well in mathematics. In his view the affirmative action is playing a similar role in inculcating the idea that they are not meant for mathematics. Thus, according to him the environment is telling the female students that they are not supposed to perform well in mathematics. As a result they will be discouraged to work hard on mathematics which affects their achievements in the subject.

According to ministry of education (2003) the affirmative action is meant to make gender equity in tertiary education by increasing female intake and reducing their attrition rate through quality tutorial services and creating an enabling environment. I believe that the affirmative action needs to be studied again to identify its pros and cons. It seems that it didn't get the consent of some instructors and some male colleagues. It seems that the consent of all the parties involved in higher institutions might be important in the design and implementation of the affirmative action. I believe that it might be difficult to effectively implement the affirmative action in an environment where the instructor believes that it is against the female's confidence, and the male colleague believes that every female student's achievement is because of the affirmative action and is against his interest.

Some female students perceive that house hold tasks make the female student very busy. As a result, she shifts to other subjects which she assumes will take a lesser time. The following excerpt from the story of **Solome** is indicative of this fact:

Because mathematics takes much time and female students are busy with household tasks, especially in the rural areas, when they get time they tend to study subjects, which involve reading. Household tasks obstruct the female's academic career particularly in mathematics, as mathematics needs much time. But, other subjects that involve reading do not take much time to study; thus she shifts to other subjects (Solome, 2006).

She feels that the learning environment did not provide a favorable condition that enables the female student to exert the maximum effort that mathematics requires especially for the female students from the rural area.

Some instructors have the same view that females are busy with house hold tasks which may take much of their time which they could have allotted for studying mathematics. This is apparent when the focus group participants in Ambo College say:

On the contrary the female students are busy with household tasks as well as with taking care of their beauty. This takes much of their time which could be allotted for studying mathematics (focus group discussion with mathematics instructors, 2006).

These instructors perceive that the female students are busy with one or both of the factors which take much of their time that they could have allotted for studying mathematics. They mean that the social context expects the female student to take care of her beauty as well as be engaged with house hold tasks. Both take much of their time which have negative repercussion on mathematics achievements. This communicates an implicit message to the female that she should stay away from mathematics.

Some male colleagues have stereotypical attitudes on females' capabilities. The following excerpt from the story of **Firehiwot**, tells us how this might affect the females destiny:

I liked chemistry and physics than the other subjects. Next to these subjects I liked mathematics. I never liked biology since grade 9. ... My second choice was biology, next to chemistry. Because my seniors, who came from the locality where I studied high school, advised me to study biology saying females are good at biology (Firehiwot, 2006).

Actually, she knew that she is not good at biology. At the same time she knew that she is good at chemistry. But, somebody else influenced her to believe that she is good at biology than chemistry, physics and mathematics.

From her story I understand that there is stereotype that females are better in courses, which involve reading, like biology than in courses, which involve mathematics. This can affect the focus of attention of some females' and the course of their destiny.

The male students' stereotyping of females as not meant for mathematical fields interferes in the learning activity of some female students. It may let her be convinced that studying mathematics is not meant for females resulting in a discouragement in the face of challenge in her academic career. She may say, 'it is not expected of me to succeed in such courses. Why should I bother?' It may induce lack of motivation. According to Bernstein (2000) much of human behavior is motivated by a desire for approval, admiration, and achievement. So, appropriate guidance for the female is required for the success of closing the gender gap in the area of education. **Firehiwot** has another story in connection with the environment for female's learning:

In high school I was to terminate my school life when my father died. ...My mother did not have job. There was no body to support the family. Then, my relatives and people around encouraged me to pursue (Firehiwot, 2006).

The impact of losing a father is not only psychological, but also it is economical. It is a discouragement as well. But, her courage revived by the relatives and by the people in the locality she was living, which is in a way an indication that the community around accepts her as a student. Such encouragements will induce a feeling that the community accepts her education career. Though it may seem that this does not have direct impact on mathematics achievement, in the long run, it will induce patience and stamina that she perceives is needed in studying mathematics. It may compensate for the unacceptability of her mathematics achievement by some colleagues.

Some female students believe that the attitude of the society on female students' achievements is a draw back in females' learning. The following excerpt from the story of **Beletu** is an indicative of this fact:

I feel that females are not strong. May be because there is a belief among the society that she is not strong, and she inherits that. ... I am accustomed to the male teachers but I believe that if female mathematics teachers/instructors are in the institutions the attitudes of the society would change, and the female students will be motivated to work hard and be successful in mathematics (Beletu, 2006).

She understands that the society creates some impacts on achievements of female students in that it communicates the idea that females are not strong. She believes that this idea affects the females' strength and hence, their mathematics achievements. This could be true because some female participants believe that mathematics requires strength. According to her changing the society's attitude and maximizing the females' motivation could be possible by increasing the number of female mathematics teachers/instructors.

We can see how an encouraging environment at least at the family level can affect a female student's performance from the following excerpt of the story of **Beletu** when she says, " When I was in grade 8, my mother was happy at my result. I performed even better in grade 9 to please her. Then, I stood 2nd in my class" (Beletu, 2006).

So, for her the learning environment has become better. It was encouraging. It motivated her to achieve better. Such encouragement is very important in affecting some female students' self-perceptions of their mathematics achievements because they perceive that mathematics requires encouragement. For Beletu the learning environment has been paved by her mother. Because her mother has induced the strength and stamina that she requires in the face of obstacles she may be facing (look at her story in section 4.3.3).

The other side of the environment as an unfavorable to females' mathematics learning is reflected in Etagegn's:

When I was a freshman student, the mid term exam in mathematics was very difficult; however, I scored a very good result. Then, rumors were running about me that I had an affair with the instructor and that the exam was given for me before the exam date. See, I was not the top; another student has scored even better than I did. But, he is a male. ... Now, everybody has realized that I can do (a smile of confidence) (Etagegn, 2006).

I understand that the environment is telling her that she is not supposed to perform well in mathematics. If she does so, the credit does not go to her. On the contrary, she will be labeled as deceitful; moreover, she will be harassed of committing unfair relations for the sake of earning marks. So, in addition to the struggle to be successful, a female needs to pay for the pain of negative feedbacks for her good achievements, which did not accord the natural expectation of her environment.

From my field observation, I have come across a view of a statistics instructor who showed a stereotypical attitude toward the achievement of the female students. It was the day on which he returned back the mid exam paper for the second year statistics group. He first asked them about the exam, and then he dispatched the exam papers for the respective students. After, I made the classroom observation in that class; I held a brief discussion with him.

The following is an excerpt of the story told by the statistics instructor:

One female student scored a good result I didn't expect from her (he mentioned her name – she is Senait - a participant of this study) ... I have never come across a research, but I think that the females are good at language and reading and the males at mathematics (field note, 2006).

The fact that Senait scored good result made the instructor happy. But, his expectation that she is a low achiever together with the assumption that mathematics is a male domain, may have a negative repercussion on females learning. The perception he has may some time be revealed some how in his teaching activity. I believe that it is good for the teacher to come to class with a tangible data on the student's previous achievement instead of having a stereotypical assumption of her/his performance.

It was that very day when the statistics instructor dispatched the mid exam paper to the students that I observed Senait being harassed by a male colleague which may seem a mild one. A student was moving from the back towards the instructor to complain about his score in the exam. While passing by, he touched her on the forehead. She reacted with a disappointment, but when he returned back he sat in front of her and was talking to her. I requested her to discuss about the issue. After I got her consent, I reminded her of the whole scenario. Then, she said, "This student has such a habit. I couldn't avoid him. So, what I can do is when he tries to do something odd, I just smile. Then he stops".

In the absence of proper follow up and action against harassment, the female student is forced to devise her own mechanisms of avoiding threats of worse harassments; usually a diplomatic way, like smiling. An expert in the gender office of Jimma University also believes that female students face problems in the library, in classroom as well as in the lecture halls while studying. This is apparent when she says:

We haven't yet a reported case where female students are severely attacked. ... During the orientation as well as in

the girls' welcome programs; we tell them to come to our office whenever they face problems. We have the information that female students face harassments in the library as well as in the lecture halls. We have made a request to the administration to get a separate reading room for female students, but because of shortage of space we didn't get positive response. But, to overcome the shortage of books they are facing, we provide them a free photo copy service (field note, January 2007).

I believe that harassment is a severe attack which has lots of repercussion in the educational career of the student. At least, it distracts the student's attention while studying. It may also induce a feeling of helplessness and insecurity in the absence of proper follow up and immediate action by the responsible body.

After my observation of the library, I held a brief discussion with the acting head of the technology library. He said:

We are informed about incidences of harassments of female students (touching by leg under the table and the like) in the library, but no female student has ever reported to us. We just hear it from others. Hence, we could not take any measure. 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 never report (field note, January 2007).

Perhaps, telling may not change the situation. The learning environment should serve all the students equally. For a female who had been in a situation in which she is encouraged to be unassertive, it may be very difficult to express the problems she is facing. Even a female student may hide incidences which are seen to happen in the presence of the library workers to avoid later revenge (Cf Ambo College Library head in section 4.1). Thus, there should be follow up and action accordingly.

Thus, I understand that the learning environment is not conducive for females' mathematics learning as female students perceive that mathematics learning requires more concentration, strength, encouragement, patience, group work. They perceive

that their mathematics learning is not well accepted by the family, the male colleagues, the university community, as it has been in the society. Harassments are not identified and regulations are not set for them. I understand that the females have a feeling of insecurity, which might have hampered their freedom of interaction which they needed for mathematics learning. The cumulative effect of such environment may be discouraging for the female student and may force her to stay away from mathematics.

4.3.3 I Don't Have a Role Model

In here, I try to describe the role model the female student has set; whom she was following, and the relevance of her role model to her academic career and to her sex.

Observation of similar models affects self-efficacy ("if they can do it I can too") (Schunk, 2000 in Woolfolk 2004: 319). Thus, in learning models are very important. If the choice of model is similar in nature to the learner, it is very likely that the learner is motivated to set and achieve a certain goal which is similar to the model. Thus, it is very important to avail models for students which are similar to the learners and of the intended quality that the learner is supposed to attain.

Woolfolk (2004) reveals that high sense of self-efficacy in a given area enables one to set higher goals, be less afraid of failure, and find new strategies when old ones fail. If our senses of efficacy are low, we may avoid a task altogether or give up easily when problems arise (Bandura, 1993, 1997; Zimmerman 1995 in Woolfolk, 2004: 369).

Some female students at Jimma University perceive that mathematics is very difficult subject and it is difficult to sustain. They believe that it requires strength, patience, encouragement, and many more things. If students will be encouraged to perform well in a certain task when they see models that are similar to them performing the same task; then that might give the strength and patience that some female students believe to be a requirement for learning and achieving well in mathematics.

For some female students who see mathematics as something difficult to sustain in achievement, they may need to see models who have sustained in their achievements. The following is an excerpt taken from the focus group discussion with mathematics instructors at Ambo College which is indicative of this fact:

There is a feeling among female students that it is the male students who can understand mathematics, because this is what they see. But, males can see other males achieving, and hence they get motivated. Thus we see that the males are active in class. ...the mere fact that the mathematics teachers are males induces a feeling of unrepresentedness on the female students. Hence, creating an assumption that mathematics is not for females (focus group discussion with mathematics instructors, 2006).

Thus, these mathematics instructors see having models as one important factor in the gender difference in mathematics achievements.

Some female students could select their role models from what they come across at school in any way. Female students may model a male. The following excerpt from the story of Etagegn is indicative of this fact:

When I was in grade 7 & 8, I had a good mathematics teacher. I used to wish to be a good mathematics teacher like him, even up to grade 12. Actually I had good mathematics teachers all through. ...I had a female biology teacher in grade 7. She used to tell me that I will become an engineer. She used to say 'you are going to construct my house.' Then, I was inclined to becoming an engineer. ...I wish to become an instructor here in Jimma University and be a role model to other female students. ... There was such an activity by the gender office-introducing high achievers to the new comers when we first came here. But, now there is no such activity

She chose her role model from what she saw in her school life. She was not aware of being a female or a male then (Cf Etagegn in section 4.3.4). Her mentor in becoming an

engineer is her biology teacher. She believes that there should be role models for females, and she wants to be one.

Some female students have no role models, but they take their brothers as their mentors in receiving guidance even if they are not successful in their academic life. The following excerpt from **Senait**'s story is exemplar of this fact:

I do not have as such a role model but I follow my elder brother. He advises me. He encourages us for higher achievement. ...He supports us both morally and materially. ...He is a merchant. ...He is the leader of the house next to my father. He is a high school dropout. I have never seen in my locality a female any more than a secretary or one working in a record office.

She follows her elder brother who is not successful in his academic career, but leader of the house and backs her academic career. She has never seen a female who is successful in academic career and is engaged in a job in her vicinity, which could have enabled her to select an appropriate role model.

She sees her elder brother as a role model. I feel that absence of appropriate role model forced her to follow her brother. She began to be motivated when she saw a female mathematics teacher, but couldn't keep up. According to Bandura cited in Slavin (1994) students may tend to follow those people who have prestige.

Some female students follow their brother who they perceive is successful, and lead the house. The following excerpt from the story of **Etaferaw** is exemplar of this phenomenon:

I am not close to my sister. ... I take every thing that I think is good from all members of my family. I follow my elder brother. He usually advises me. He is good at mathematics has MA degree in journalism. My father listens to what my elder brother says. What my father has decided may be reversed if my brother says so ... I had a classmate who

was standing 1st in my class excelling the male students in grades 0 to 8th. ... When I was in high school, I tend to ask my friend who at the same time is my neighbor. She was good at mathematics. She used to stand first in my class excelling all the male students. She is now studying engineering in another university. ...I had female teachers in grades 7, 8,9,10. I used to wish to be successful like them in what I want. (Etaferaw, 2006).

Though she had few female teachers they were not in mathematics. She had the chance to have a successful sister in mathematics. She follows her brother than her sisters or her friend who are high achievers. In trying to achieve like her brother whom she believes was good at *mathematics*, but has MA degree in another field, she would feel desperate. She might in the mean time remember what was in her tacit knowledge; that he is a male and she is female. So absence of role model may be one reason that might hamper her achievement in mathematics even though she liked it.

It seems that some female students model a strong sister and a leader of the house this apparent from the story of **Muna** when she says:

I don't as such have a role model. ... I follow my eldest sister. ...She is the leader of the house. I rather sympathize for students coming from the rural areas, where there are no books and appropriate teachers. Sometimes, there are no teachers for some subjects. Yet, these students are supposed to compete with students coming from the cities. ...I don't remember a female mathematics teacher. ...I don't see any problem in having male or female teacher or instructor. ...In our family everybody is treated equally. ...I had the freedom to go to my male colleagues' houses; the male colleagues as well were coming to my home. This is true both when I was in Addis with my sister as well as when I was living with my parents in the rural area. ... I don't think the society in the rural area I grew up was any different from my parents. ... It was free (Muna, 2006).

She doesn't know some body to be like. Her elder sister - a merchant - is one she follows. She was living with her sister after she left her parents in the rural area, with whom she was living, while she was in elementary school. All through, she had been enjoying the

freedom to interact with male colleagues as well as female colleagues. She had never come across any boundary of male female segregation.

Thus, she could clearly imagine the problem in being successful in the rural areas where books and teachers are not adequately available. However, she couldn't see the problems of being successful in the absence of freedom for interaction with male colleagues, instructors, and in the absence of experience in free communication and group work and the like which the female had been deprived of.

Even though books are available in the library, they are not really available for the female students in high school. Their access is denied by their parents or male colleagues (refer to the stories of Fikirte and Senait in section 4.3.1). Books may be available in colleagues' hands. But, it is hard for the females to get it because parents are not happy with their daughters' interactions, especially with male colleagues (Cf stories of Senait, Etaferaw, and Fantu in section 4.3.1).

Muna might not see the context in which her female colleagues are situated. Actually, she might not see any advantage in having a female teacher. May be because she was brought up in a family where there is no male/female segregation (Cf the story of Muna in section 4.3.1).

Thus, I see that she couldn't set appropriate role model. But she was successful in mathematics because she was freely interacting with colleagues and teachers. She didn't inherit from her family that being a female is any different from being a male in relation to freedom of interaction, achievement and performance.

She had a strong sister who leads the house. She follows her. Thus, it seems that what she has been observing in the family, the freedom they let her to enjoy in interacting with males and females, the fact that she was in a free society gave her a good foundation that couldn't be eroded by the school/university environment. Our knowledge and perceptions

of reality are socially constructed and we are socialized in our upbringing to share aspects of that perceived view (Kim, 2001).

It seems that having as a strong mother who leads the house as a mentor would serve a great purpose as in having a strong sister who leads the house. The following excerpt from the story of **Beletu** is indicative of this fact:

*I follow my mother. She was strong and was leader of the house... I believe that she has left me with the stamina to overcome challenges even after her death. ...When I was in elementary school my role model was **Kebede Michael**, because I used to wish to become a writer. My mother used to appreciate what I write. But she also advised me to concentrate on other fields like medicine. ...Then, I begin to wish to become a medical doctor. ...After I read the book entitled 'the gifted hands', my role model turn out to be **Ben Carson** - one of the best neurosurgeons in the United States.Now my role model is **Albert Einstein**, but we are in different fields (Beletu, 2006).*

I understand that the orientation she has built has served great purpose in her adjustment to the learning environment. She was oriented by a mother – a female in the absence of her father, who died earlier. She gets good feedback from her mother, which motivates her to achieve more.

She gets the guidance about what to do from her mother, and she gives it a serious attention. I understand that the guidance was given in a way that she establishes it in her personality and makes it an integral part of her life by accepting it and be convinced in it.

She had a role model of opposite sex, and she sets a role model following her interest: **Kebede Michael** was her role model because she wanted to be a writer. Still the appreciation of her mother was there. It is important to observe the way her mother imposed her interest on her child. She was quite strategic. She didn't reject her daughter's interest but she strategically took her away from her way of becoming a writer to that of

becoming a medical doctor. In here, as well, she set a role model following her interest – she took *Ben Carson* as her role model because she wanted to become a medical doctor.

Some female students don't have role models and tend to follow a member of the family who advises them as their mentor. This is indicated in the following excerpt of **Firehiwot**, "*I don't, as such, have a role model. I follow my father. ... He has learnt till high school only. ... He used to advise me*" (Firehiwot, 2006).

She doesn't have somebody in her mind which she wants to become like. She just follows her father. He learned to some level in high school only. She couldn't set an appropriate role model.

Some female students tend to set their role model from what they observe in their vicinity. The following excerpt from **Fantu's** story is exemplar of this fact:

I tend to follow my mother. She is not educated, but she encouraged us to learn. The leader of the house is my mother. My childhood dream was to become a medical doctor; because I was impressed by the female medical people I saw when I visited the hospital as a child. ... Since grade 7, I had female teachers. Then my wish turned out to be becoming a teacher. ... I had never had a female math teacher, but I had female teachers in English and other subjects (Fantu, 2006)

She follows her mother as her mentor who is not successful in academic life. As she grew up and come to observe people in academic career she came to see other females other than her mother as a role model.

She mentions of having female teachers whom she considered as role models. As she further grew up in school, now that she came to see females whom she can follow, she turned her face in the selection of role models to the school, because she is observing females who are successful in academic life in her vicinity almost every day.

She chose her teachers to be role models, but the female teachers she had been observing were not such that she will be motivated to concentrate in mathematics. Her role model couldn't be a mathematics teacher, because she never had a female mathematics teacher.

She has never been performing well in mathematics, since elementary school. Moreover, her male mathematics teachers used to get angry at her performance, which, according to her, further discouraged her achievement and interest in the subject (her story in section 4.3.1).

In the different levels she passed through she was seen to be motivated by observing females – medical professionals in the hospital and teachers in the school.

Learning and motivation are equally essential for performance: Learning enables us to acquire knowledge and skills, and motivation provides the impetus for showing what we learned (Elliott, 2000:332).

It seems that the academic status of the student's family members may important in motivating the female student for better achievement. This is apparent from the story of Beza:

My mother has graduated from a teachers' training institute. ...my father tells us to study science courses. He always said that natural science is better than social science. ... I tend to follow my father. He is successful - he has an MA degree in business (Beza, 2006).

She follows her father who is successful in his academic career. She joined the science stream because her father insisted. Despite, the fact that she doesn't have the patience in doing mathematical problems (refer to her story in section 4.2), she is successful in mathematics (look at table 3). She gives the credit to her mathematics teacher. This is apparent when she says:

My mathematics teacher in 11th grade used to encourage me to do well on mathematics. He used to tell me that I am good at mathematics. Then I began working hard on it (Beza, 2006).

She was motivated to do mathematics after her mathematics teacher in 11th grade convinced her that she has the potential to perform well on mathematics. Thus, the mathematics teacher as a mentor and her father as a role model and the whole educational environment in her house might have served great purpose in her achievement of mathematics.

The focus group discussion I held with instructors indicates the importance of having female mathematics teachers for the females' mathematics achievement. The following is an excerpt from a focus group discussion with mathematics instructors:

I remember a person who loved to be and became a history teacher because of his history teacher. ...There are no female high achievers in the scene. ...They had few or no female mathematics teachers, which may show them that mathematics is not for females (focus group discussion with mathematics instructors, 2007).

According to the focus group discussion participants, the lack of female mathematics teachers/ instructors in the scene may make the female student to be desperate about being successful in mathematics.

Thus, absence of appropriate role model seems to be one factor that might lead the female students to perceive that mathematics learning and achieving is not meant for females.

4.3.4 The female is a Guest in the Mathematics Class

In my classroom observation in statistics class, I saw that the female students are concentrated around the front right corner of the room close to the door. I observed the

same thing in the mathematics class. There was no change in the sitting arrangement, in the days to come as well. After the sixth lecture of my classroom observation, I requested the female students for a brief group discussion. I mentioned where each individual was sitting in each class. They laughed; as an indication of surprise. It seems that they didn't pay attention to it. They said,

We just sit where ever we find it comfortable. We could sit else where it is a matter of chance that you found us concentrating there [but in hesitating manner] (field note, January 2007).

I understand that they didn't see their acts critically. But, the impression I had is that they don't take the classroom as theirs. They tacitly assume that they are guests in that classroom. They don't sit in the middle, in the back or opposite to the door, in which cases they pass across the classroom. They don't do that. They just sit near the door as a guest coming to your house does, as s/he is not free and comfortable to cross the whole of your saloon.

In my classroom observation I also witnessed that no female voice is heard in the class. Even when the instructor asked questions in the middle a male voice answers it, and no female voice is heard. This was always the case in all my classroom observations for six lecture hours. Their explanation for this incidence of silence was as follows, "*It is natural that the male students answer the instructors' questions. Even if we know the answer, we don't respond (field note, January 2007).*"

Again they have the tacit assumption that the class is males' class, and they are guests who are supposed to be silent observers; not active participants. They take this act as natural; may be because they are socialized to it.

Females may be treated as guests by their school teachers. The following excerpt from Etagegn's story reveals this fact:

In 11th grade we had a teacher who used to say 'yes females why don't you participate? ...Now it is the females' turn to answer.' It is then that I begin to think of being a male and female. Before that when I didn't answer a question, I used to think that I didn't know the answer (Etagegn, 2006).

Words which we don't think are hurting are some times very harmful. The teacher wanted to encourage the female students. He didn't mean to hurt them. Actually it hurts, because it is an indication of segregation of a participating group (the males) from a nonparticipating group (the females) by sex. It may also mean 'hey guest feel free'. It may sound like the Amharic saying 'Engidaw Techawet'.

Classroom participation or being an active part of the class may be conditional. The female students can interact and take themselves not as guest but as part of the environment when the condition is favorable for them. The following excerpt from the story of **Solome** indicates this fact:

While I was in grade 9, my mathematics teacher was a female. She was a good teacher. I begin to like mathematics because of her. I used to participate in class. Though I was not that much good at mathematics, she used to encourage me (Solome, 2006).

When she had a good mathematics teacher who encouraged her, she began to consider herself as an integral part of the mathematics class, not as a foreigner or a guest. She developed interest towards the subject. It was a good beginning for her towards better achievement in her mathematics academic career. The fact that the teacher was a female might have served great purpose in her feeling that she is an integral part of the class.

In my classroom observation, I witnessed that the instructors were trying to draw the females' attention, by visiting them when exercises were given to the class. But, I also observed that the instructors have poor eye contacts with female colleagues. The instructors rarely turn their faces (field note, *January 2007*). Every act in the classroom

must be taken seriously. Poor eye contact may induce a feeling of out cast; as close eye contact may induce a feeling of belongingness to the class.

Female students may be seen as guests by their university instructors. It seems that some mathematics instructors perceive that it is safer to see female students as guests than to take them as integral parts of the learning activity. The following excerpt from the focus group discussion I held with mathematics instructors at Ambo College, is indicative of this fact:

It is difficult to have a close interaction with a female student; it may turn out a change of feeling in either or both sides-the instructor and the female student. But, in the case of the male students there is no problem (focus group discussion with mathematics instructors, 2006).

It may not be a deliberate act, but as a means of risk avoidance, male teachers may tend to avoid eye contact as well as free interaction with female students which again has a repercussion on the females' mathematics learning. In this way the female student is seen as a guest by her instructors/teachers.

There are incidences where male colleagues see the females as not part of the mathematics classroom. Students who are enrolled in mathematical fields are not expected to survive and graduate. An excerpt from the story of **Firehiwot** confirms this fact:

There are male students who don't have confidence in our capacities. Some students say, 'endet eske ahun altecharachuhum' [meaning 'how do you come to survive?']" (Firehiwot, 2006)

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 department, which is not meant for females. Thus, she is considered as a guest in the mathematics classes as well as in the departments which involve mathematics. She also considers herself as a guest in the mathematics classes as well as in the departments which involve mathematics.

Thus, the situation where the female student is not seen as an integral part of the mathematic class, might lead her to perceive that mathematics learning and achieving is not meant for females.

Unit five

SUMMARY, CONCLUSIONS AND IMPLICATIONS

5.1 Summary

Thus, in summary the analysis has shown that some female students in Jimma University have the perception that females have lower achievements than their male colleagues, even though there are individual differences among the female students. They see that studying mathematics is not paying for female students in that it requires many things, which the female may not have. Some mathematics instructors in Jimma University perceive that male students have better mathematics achievements than their female colleagues.

Some of the factors which contributed for the perceptions of the female student participants about their mathematics achievements are

- The female student participants are almost banned by their parents not to interact with colleagues - by being forbidden not to go for group studying or bring their friends to their homes which had repercussion in their interaction and lack of experience in group work and other forms of classroom interaction. In addition, availability of a colleague to ask and discuss in case of doubt faced is a drawback. Since most of the students in the departments which involve mathematics are males, the female students, especially those who are poor at interacting with males feel that learning and studying mathematics is a very tough task because the female student participants see group work as a necessity in mathematics learning and achievement.
- Male colleagues may obstruct their free movement by physical interference which can have a double effect on their academic career: it directly obstructs the female