FEMALE PARTICIPATION IN HIGHER LEVEL MATHEMATICS EDUCATION

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AN ABSTRACT OF THE DISSERTATION OF

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Abstract Approved _____

Assoc. Prof. Bal Chandra Luitel, PhD, Dissertation supervisor

My childhood and college life experiences increased my interest in women higher level mathematics education as I witnessed a lesser number of women and girls students in my classes. In the context of Nepal, women are covering half of the sky (50.05%) but their literacy rate is far lower in comparison to male (Female 42.5% and male, 65.1%, Census, 2001). My experiences and observation of the participation of girls in higher level mathematics education in different universities show that there is a very low participation of girls (around 10%) in the classroom. It also showed that socio-cultural dimensions are the main barriers for girls' higher mathematics education. So, initially I generated two research questions to identify and understand the causes behind low participation of girls in higher mathematics education. However, these research questions were modified later and which in turn brought about more research questions.

I used interpretivism as my research paradigm. The paradigm of interpretivism enabled me to employ emergence as the characteristic feature of my inquiry. So, my research questions were modified many times. Finally four research questions were generated on the basis of socio-cultural dimensions including pedagogical and policy programs factors on girls' higher education. I used an open-ended in-depth interview to explore the problems and get responses from the participants to understand the problems

of low participation of women in higher level mathematics. As I wanted to understand the phenomenon of low participation of women in higher level mathematics, I chose narrative inquiry as my method of research.

I interacted with the participants on the basis of the research questions. And with the interaction with them, I came to realize that girls' participation in higher mathematics education was low. I found socio-cultural dimensions like parental beliefs system, early marriage and public image of mathematics as the root causes for low participation of women and girls in higher mathematics education. Further, lack of proper preparation of girls in mathematical knowledge has made them not to opt for mathematics education in their higher level studies. Moreover, lack of sufficient programs and policies that empower girls in higher mathematics education are other the barriers on girls' higher mathematics education.

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Man Kumari Thapa Magar March 12, 2012

Degree Candidate

DEDICATION

This dissertation is dedicated to my parents who taught and inspired me to walk on the path of educational journey. To my brothers and sisters who supported me in every step of my life.

DECLARATION

I hereby declare that this dissertation has not been submitted for candidature for any other degree.

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Man Kumari Thapa Magar, March 12, 2012

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APPROVAL

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I understand that my dissertation will be a part of the permanent collection of Kathmandu University Library. My signature below authorizes release of my dissertation to any reader upon request.

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Man Kumari Thapa Magar, Degree Candidate March 12th, 2012

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ABBREVIATIONS

ARNEC	All Round National Education Commission
BPEP	Basic and Primary Education Project
CERID	Resource Centre for Educational Innovation and Development
EFA	Education for All
ERIC	Educational Resources Information Center
HLM	Higher Level Mathematics
ICT	Information and Communication Technology
INGO	International Government Office
KU	Kathmandu University
MDG	Millennium Development Goal
MoE	Ministry of Education
MTED	Mathematics Teachers Education and Development
NCTM	National Council of Teacher of Mathematics
NESP	National Education System Plan
NGO	Non Government Office
SLC	School Leaving Certificate
TU	Tribhuvan University
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNRISD	United Nations Research Institute of Social Development

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CHAPTER I

INTRODUCTION

"Educating a man is educating an individual, while educating a woman is educating a family"

- Mahatma Gandhi

Chapter Overview

This chapter deals with my research agenda and articulates my interest as a researcher. Including my experiences regarding female participation in higher mathematics education, I make a case of the data of enrollment of the girls in higher mathematics from colleges and universities to establish the context of the research. So, this chapter also discusses current practices of female participation in higher mathematics. Further, it elaborates on the ideas why I chose the topic for my research. Furthermore, I include problem statement and research questions to address the problems of this research. Then, I discuss the methodology which is required for my research. Within methodology section, I discuss the research paradigm, research method, data sources, selection of research site and participants. Similarly, I discuss quality standards and ethical consideration before ending with the chapter summary.

The Journey Begins

When I was in school, I did not think about the inequality from the family and society between the son and the daughter. At that time, I also did not notice whether my friends had got supportive behavior from their family or not. But my family environment where I grew up might be the main reason for this situation that I was free to do the things what I wanted. However, there were some limits, I got time and

support to study from the family. I was known as a responsible daughter for my study and household work in my family. So, my family did not create an unfavorable environment for my study.

> ***Reflective Spot!***
> *I arrived at Kathmandu aiming to pursue Master's Degree three years ago. I joined Kathmandu University where I came to know about 'research' in mathematics for the first time in my life. I was much surprised to carry out research in mathematics. I was completely unknown about the research methods and philosophy. When I was in my bachelor degree, I just heard that we should carry out a research in master's degree. But I did not know anything what that research was and how it was done.*

When I passed the school level, I found differences between me and my school friends regarding higher education. Most of my lady friends got married after the SLC whether they passed the SLC exam or not. Mathematics, Science and English were the main reasons behind not passing the SLC exam for them. Till the moment, I did not think why they failed in those subjects. The lives of my lady friends changed because they failed in the SLC exam. Very few friends got chance to attend the SLC exam the second time but most of the girls did not get chance to attend the exam again. I did not get any ideas why they could not get the chance to attend exams the second time and why they were not motivated for higher education at that time. Perhaps, I was unaware of the key hindering factors causing them to discontinue their study.

Though I am a girl, I have not been prohibited by my family regarding my education till now. However, I have a bitter experience after passing the SLC exam. I was only one girl who passed the SLC exam in the first division from my school. This made me so happy. After SLC, I had to leave my village and had to stay in the city for my further study because there were not any +2 colleges in my village. I did not find any ladies to stay together in a rented room in the city. Therefore, my father told me

to go with my brother who was far from my hometown instead of staying alone in the city nearest from my village. Thus, I felt sad as being a girl myself and existing belief system of my parents and society as well. I wanted to study in the city which was near my village. But I did not get permission to stay alone in the city and went with my brother. From this experience, I found that boys are free to do what they want but girls need to get permission from their parents. Overall, my family was very supportive and they encouraged me to study. Therefore, I was sent with brother to study the intermediate level. Finally, I was able to join master's degree and establish a researcher inside me. In this regard, Osho (2006) says that each child is born with great possibilities and potential. If s/he is allowed and helped to develop her/his individuality without any hindrance from others, s/he can perform better in academia (p. 42). Despite some unhelpful beliefs about girls' education, my family's supportive environment encouraged me to study that I could come thus far.

> ***Holy Ghost: Dissertation***
> *Once I was talking to my seniors in the university premises about studying here in Kathmandu University. They shared with me that the most difficult task of completing the degree was to write a dissertation.*
>
> ***Dissertation! and Dissertation!***
> *This is the turning point of my study I started to focus more on research. First of all it was easy to be linear while following the footsteps of positivists. I gradually learnt to carry out the research and took it for granted but at present I realize that nothing can be taken for granted because there are multiple ways to frame the research.*

From the very beginning of my school life, I was very much interested in reading and writing in the classroom. I was known as an 'obedient' and 'talented' student. My teachers always asked me to monitor the classroom and teach the rest of the students writing on the blackboard. I used to do household works as well according to my interest. So, my brothers used to tell me that I had an exam so why I was busy on household work. However those household works did not exert effects

on my study because we (our family members) were responsible for household works and study according to our will. In this way, my childhood went on without any restriction and prohibition from my family.

Speaking of mathematics learning, till lower secondary level, we (girls and boys) participated equally in every reading and classroom activities including mathematics. However, I found a vast gap between me and mathematics due to Algebra and Geometry in the school level. I never attempted to solve algebraic problems but solved only a few geometrical problems in examinations. Class eight was a milestone of my learning mathematics. In this class, I found myself very near to mathematics because my teacher taught us effectively and tried to link with our daily lives. After all, mathematics became one of my favorite subjects at the end of class eight. In class nine, there were two optional subjects like geography and optional mathematics for the students. We were four girls and twelve boys in optional mathematics out of seventy students. Rest of the ladies said that mathematics is a hard subject so they did not study. Briefly, I understood from their voice that mathematics is a hard subject but I was unable to make wide sense on why there was lower number of students in mathematics than geography and why girls' number was lower than boys in optional mathematics classroom. In such a way, I passed my SLC exam and mathematics always remained my favorite subject in the school.

∞ ***(Dissertation)!***
Classes were running but I could not catch the footprints of research in the first and second semesters of Degree in KU. The temperature of research had been searing up. However the importance of dissertation is infinitive in KU. I could not escape from the infinitive, instead, I became its part. Nonetheless I completely lost the way to carry it out because at that time I thought in a linear way which was not possible to capture the reality of multiple realities of female participants of mathematics.

After the SLC, I joined higher secondary level (+2) selecting mathematics as the major subject. The day which is still in my mind was the first day of class eleven. That day I found myself the single lady in mathematics classroom because my female mates were already away from me after the SLC due to their marriage and failure in the exam. From other schools also, I did not find any girls in mathematics classroom in class eleven. I was only one girl among six students of mathematics education. So, I was worried about having no girls in mathematics classroom and that was my first bitter experience to stay in the classroom without females. I did not accept easily that boys were also my friends. Later on, I became habituated with that environment. Till then, I did not think about the low participation of girls in mathematics education. I passed my higher secondary level in such environment. Then I joined bachelors' degree in mathematics education. Again I found the same situation in classroom enrollment of girls in mathematics education. There were only twelve girls out of forty students in the classroom. From this situation, I assumed that girl's participation in higher mathematics education is low.

After the completion of my bachelors' degree, I joined masters' degree in Tribhuvan University (T. U.). The students were from different parts of Nepal in the same classroom. While interacting with friends, we talked about the past days regarding the participation of girls in mathematics studies. I also came to know the same situation prevailing in the other parts of Nepal. Since then, I made my mentality to carry out my research on the low participation of girls in mathematics education and to dig out possible pedagogical and socio-cultural barriers on it. After spending a year in T. U., I joined Kathmandu University (K.U.) in mathematics education. I observed the same situation in K. U. where I found only two girls out of ten students

in mathematics education. So, this situation also helped me to decide to carry out my research on this topic.

Female Participation in Higher Level Mathematics Education

The history of women education is as long as human civilization. "From the past many decades, Nepalese young women were given only religious education by their fathers, uncles and elder brothers or by priests or teachers which were known as religious Guru" (Sharma, 2000, p. 27). Perhaps, the purpose of such education was to familiarize the women with religious texts and practices and there was no intention of fostering women's personal development and consciousness. Regarding the issue of women and their development, women represent half of the total population of the world and their contribution in development activities can never be ignored. Tripathee (2004) says, "Education plays a key role in promoting the interests of women and increasing their diversified impact and contribution to national development goals" (p. 180). The task of nation building is difficult without encouraging the equal participation of women. Thus "in order to accelerate the rate of development, women's participation in development activities must be actively mobilized" (Sharma, 2000, p. 47). Higher education arrieved in Nepal with the establishment of the Durbar High school in 1853 (National Education Commision , NEC, 1992). But the history of women's higher education is not so much older. Higher education for woman started late in Nepal. It was only in 1952 A. D., that a girl's college was established. So, I can

Befriending Research Skills

I come to know about the semester system of Kathmandu University and felt to cope with it. However, I was able to pass first two semesters without any tension. But the underlying tension of dissertation lies in the center of my mind and heart. I got a chance to furnish a 'few' research methods and methodology in the third semester. I found this course was not a separate one, more it was the training for research work and its objective was to develop research skills in the learners.

say that there is a historical disparity in males and females in terms of access and participation in higher education in Nepal.

Before starting my research study, I visited Tribhuvan University Faculty of Education and Faculty of Science, Kathmandu University Faculty of Education, Mahendra Ranta Campus Tahachal, Sanothimi Multiple Campus and Padmakanya Campus. The purpose of my visit was to find out the existing girls' enrollment practices of last five years (2062/063 to 066/067) in higher level mathematics education (Bachelors and Masters). Visiting different colleges and universities, I found there were only "8% girls in mathematics education (M. Ed)" (Department of Mathematics Education, T. U., 2011) and 5% girls in M. Sc. mathematics (Central Department of Mathematics, T. U., 2011) in Tribhuvan University. Similarly, I found hardly 10% girls in mathematics education since last five years in KU School of Education. Thus, I did not get satisfactory participation of girls in higher mathematics education. Kathmandu is the capital city of Nepal and huge mass of population lives here. However there are a few (less than 10%) girls enrolled in higher mathematics then what the situation of girls can be who are out of the valley.

I Met a Helpful Supervisor
During the journey of my research, I met a helpful supervisor whose insight liberated me from the linear mathematical inquiry to narrative and participatory inquiry. The supervisor was always ready to help me. His way of facilitating me developed a kind of confidence in me to include the 'emergences' in my inquiry. I learnt many things regarding research methodology from my supervisor. Developing the framework of research proposal was one of the challenging works for me in the third semester. And I know that there are many ways to employ the interpretivism in mathematical research.

Everybody takes education as an instrument of socialization and consider a powerful catalytic agent for social change. Men and women have equal responsibilities to change the society in the positive direction. However "cultural,

religion, socio-economic status and gender roles have a great influence on girls' perception towards education and have resulted to produce differences in education of male and female"(Awasthi, 2008, p. 67). There is also a growing tendency among parents to choose expensive private schools for boys and public schools for girls. Bista (2004) says, "The two tiered system of schooling is creating a further division in the society, and is certain to increase inequality and the gender gap" (p. 7). On the one hand, there appears to be socio-cultural barriers for girls' higher education and on the other hand there is school mathematics pedagogical influence on girls' higher mathematics. From different experiences, private schools seem more successful than public schools in effective teaching learning process. However, girls from public school do not seem to show their interest in studying mathematics in their higher level. Ernest (1991) states, "Mathematics is a gateway to many areas of study and a critical filter in employment. So, it is a source of inequality, it closes many educational and career opportunities to woman and deprives society of the benefits of their talents" (p. 274).

Observing the above-mentioned scenario, I tried my best to understand possible causes of girls' low participation in mathematics education and tried to provide possible solutions, suggestions and academic implications for upcoming days. According to my research purpose, I did not think that my feelings and experiences were sufficient. So, I chose six female teachers of higher level as my research participants. I shall discuss a detailed research procedure later.

My Research Problem

I came to know there are many socio-cultural barriers and school pedagogical weaknesses which influence girls' higher mathematics education from the discussion on the research context as mentioned in the above paragraph. This context provided

me with a very brief scenario of girl's low participation in higher level mathematics education. But I felt that I need to understand this problem via the voices of participants. Being myself a female and the experiences of my life regarding girls and higher education made me conduct an inquiry on women's participation in higher level of mathematics education. There is a parallel role of men and women to develop the society and its well being. According to census 2001, women comprise 50.05% of the total population of Nepal which is more than half the sky of Nepal's population. Thus, I believe that the development of the country and society is impossible until women are equally educated as men. But the case is just reverse; the literacy rate (6 years and above) of female is 42.5% and that of male is 65.1% (Census, 2001). In this situation girls' higher education is miles away from them especially in rural areas of Nepal.

In the context of Nepal, it seems that there are very few female teachers in school and colleges. As a result, girls are not getting confidence and guidelines to study mathematics in their higher level study. They are not feeling easy to join mathematics education and parents are feeling uncomfortable to send their daughters and daughter in laws to the classrooms where male teachers teach. Koirala and Acharya (2005) say that parents and teachers play a crucial role in encouraging girls to take up science and technology education (p. 32). But the lack of property, lack of educational awareness, basic infrastructures, unequal treatment from social leaders to fulfill their daily needs, many girls are behind the light of education till today.

Girls who are getting chances to study higher education do not seem to be participating equally with boys in mathematics. Therefore, what might be the possible causes behind it? Are they socio-cultural barriers, image, anxiety, confidence and fear in mathematics classrooms to be significant factors that influence girls' participation

in mathematics? Are there any pedagogical factors that compel them not to study mathematics in higher level? How could the parents and teachers empower girls to study mathematics? Are there any programs and policies needed to improve girls' enrollment in higher mathematics? These all questions encouraged me to find causes of low participation of girls in higher mathematics. Therefore, I set the following research questions.

Research Questions

I understood that research questions are keys of research and they are the pulling substances of the research. A researcher always tries to run according to the research questions to get the direction and possible solution to the research problems. Thus, I set some research questions before the field study. Those research questions were about the influence of socio-cultural dimensions in girls' higher mathematics education. Then, my thinking regarding research questions slightly changed when I went through a pilot study and visited the field in the first round. My initial two research questions were also modified and two more research questions were added. After modifications and correction many times, I set the following research questions to address my research problem.

Major Research Question

1. Why is female participation low in higher level mathematics education?

Subsidiary Research Questions

a) How do socio-cultural dimensions influence the participation of girls in higher level mathematics education?
b) How does school mathematics pedagogy influence the participation of girls in higher level mathematics education?

Furthermore, the following question emerged during my fieldwork as my participants raised the issue of policies and programs for girls' education.

c) How can the programs and policies on girls' education play an effective role to increase the participation of girls in higher level mathematics education?

Rationale of the study

As a researcher, I raised an issue of female participation in higher level mathematics. From different experiences of my life, I understood that the role of female is very important in the society. She can contribute to the social well being in different ways. Women are equally responsible to establish good family environment. I also believe that the mother is the first teacher of the child. If a mother is educated and have the knowledge of mathematics, mostly children can make clear journey of their education from the help of mother. She can play a role of motivator to her child and advisor for the society too. Further, if there are women teachers in higher level education, the female students can feel friendly learning environment. However "In the context of Nepal, women are rarely found in position of authority and leadership in schools and career development" (UNESCO, 2006, p. 5). So, maximum participation of girls in higher level mathematics education is necessary. Thus, this study can be helpful for addressing how socio-cultural, pedagogical dimensions are hindering the girls' higher level mathematics education. Further, I tried to explore the ideas on how programs and policies support to empower girls in higher level mathematics education. Researchers who are working in the field of women education may also get benefits from this study.

Delimitations of the Study

In this study, I focused on exploring the ideas of low participation of girls in higher level mathematics education from the socio-cultural and pedagogical dimensions. I

also tried to explore the ideas on how policies and programs empower girls for higher mathematics education. I did not observe rest of the aspects which may influence girls' higher mathematics education. Due to time constraint and lack of resources, the study is limited in Kathmandu Valley. Participants were from some colleges and universities of Kathmandu valley. Among six participants, five female teachers were teaching in higher level and one participant was from different background. Her major subject in higher level was Nepali. In my study, higher level mathematics refers to bachelor and masters degree mathematics education. Unstructured and semi-structured interviews were used as my data collection techniques. Qualitative is my design of research and narrative enquiry is my research approach.

Paradigmatic Considerations

Paradigm is a mental model, belief system or a framework which guides us in research and practice in a field. Willis (2007) defines a paradigm as the general theoretical assumptions, laws and techniques for their application that the members of a particular scientific community adopt. Further, Denzin and Lincoln (2005) define "A paradigm as a basic set of beliefs that guide action which deals with principles or ultimate" (p. 183). In my research, I used interpretive research paradigm.

My research topic is 'Female Participation in Higher Level Mathematics Education'. First of all, I found the existing practices about female

Fun to Write Stories in Mathematics

My class of research methodology in university was said to be based on constructivist approach. Our tutor seemed to believe that knowledge in learners (us) should be constructed involving themselves in learning activities. So, he asked us to write our past experiences based stories so as to generate our research topic. He also said that these experiences led us to think on the research problems.
It is very strange to write stories in mathematics classroom. I was in a(n) un/comfortable zone while writing stories. I felt many problems to create scenes and setting of the stories. However, I enjoyed writing stories to contextualize my research.

students' presence and participation in higher level mathematics education from the different resources like; visiting universities and colleges, their record files, articles, reports and self experiences. From those resources, I came to know the participation of women in higher level mathematics is very poor. So, I tried to explore the ideas on socio-cultural, pedagogical and policy-program factors as barriers for female's higher level mathematics. Though I experienced low participation of female in higher level mathematics, I thought my experiences were not sufficient to meet the purpose of my research. So, I chose six participants for getting information regarding my study. I took in-depth interview with the participants and tried to get in-depth information regarding my research problems. Indeed, my focus was to develop understanding of different factors contributing girls' participation in higher level mathematics education.

Looking for the participants for my research study, I went to T. U. at first. From the teachers of T. U., I got contact numbers of other possible research participants who were female teachers of higher mathematics in different colleges and universities. Then, I visited Tribhuvan University Department of Mathematics Education, Department of Science and Mathematics, for the information of existing practices of female enrollment. I found very low enrollment of the girls/women in mathematics there. In the same way, I visited Mahendra Ratna Campus, Tahachal, Kathmandu University, School of Education, Gwarko, Padma Kanya Campus, Bagbazar and Sanothimi Multiple Campus. There also I found very low participation of girls in higher mathematics.

As I began to look into the issue in an in-depth manner, I felt that I needed to address the issue of girls' participation through a qualitative approach. Creswell (2003) states that a qualitative approach is one in which the inquirer often makes

knowledge claims based primarily on constructivist perspectives or advocacy/participatory perspectives or both (p. 18). Interpretivism is my research paradigm which deals with the understanding of people's thoughts, beliefs and social actions according to the situation. It gives importance to personal experiences of people. Thus, I used interpretivism in my research to capture each participant's perceptions and experiences on female participation in higher education. Every person tries to see the world in different way and understand it in his/her own way. They construct knowledge according to their understanding and perception depending on the situation and their experiences. Therefore, the knowledge is generated on the basis of the situation and understanding of the people. Followers of interpretive research paradigm whilst employing constructivist epistemology believe in multiple realities as various people perceive and understand the phenomenon under investigation according to their own contexts and the society where they live. According to my paradigmatic consideration, the following philosophical assumptions are included.

Ontology

Ontology is a branch of philosophy which is concerned with the theory of reality and the existence. Cohen, Manion and Morrison (2007) state that ontological assumption concerns the very nature of essence of the social phenomena being investigated (p.7). Willis (2007) further says, "Ontology is concerned with the nature of reality and various ontological positions reflect different prescriptions of what can be real and what cannot be" (p. 9).

My 'Ontology' Answer

What I think about knowledge?
Where I sink in the ocean of wisdom?
When I blink the sparkles of thought?
While generating the meaning of the female participation in mathematics class I start clarifying my philosophy. What is reality for me? That helps me to understand the situation of female participation in higher mathematics. Whole formal classes hardly enable me to conceptualize the term ontology. But this single example from the guardian angel makes me clear to understand my ONTOLOGY .

There are various types of ontological position. The positions of physical or material world believe that reality is the physical world and the position of idealism purposes that the reality is mental and spiritual. Another position of ontology is metaphysical subjectivism that asserts perception, what we perceive through our senses, and creates reality.

I tried to explore inter-subjective reality in my research. I believe that all individuals are different and they have different perceptions, belief systems and socio-cultural understandings. My research participants were encouraged to construct their realities in their own way in the process of interview. Then I interpreted them through my perceptions and progressively improved subjectivities. My research participants were free to generate and interpret their reality according to their context. I played the role of questioner with the metaphor of what the popular spiritual-philosopher Krishnamurti says of questioner as a seeker of meanings.

Feeding Human: Chinese Proverb

After his continuous guidance and the supervision, I was able to prepare a research proposal more confidently. Observing myself before initial days of research methodology class and the ending days of the same course, I found more changes in me regarding the perception of research. I remember a Chinese proverb, "Give a man a fish and you feed him a day. Teach a man to fish and you feed him for a lifetime". My tutor really built up strong confidence to develop the research proposal and he was successful to eliminate the fear of research work which was inside me for the last two years.

Epistemology

Epistemology is also a branch of philosophy which is concerned with ways of knowing. Burrell and Morgan (as cited as in Cohen et al., 2007) say that "epistemology concerns the very bases of knowledge, its nature and forms, how it can be acquired and communicated to other human beings" (p.7). In my research, I generated knowledge on the basis of my participants' understanding and responses to

research questions. Participants generated the knowledge on the research issue through their self reflection and interactions. In this regard, Cohen et al. (2007) say that in interpretive tradition, an understanding of the way in which the individual creates, modifies and interprets the world in which he or she finds himself or herself. I interpreted each participant's understanding regarding girls' participation in higher mathematics education.

Axiology

Axiology is a theory of value. Cohen et al. (2007) say, "axiology concerns with human nature and, in particular, the relationship between human beings and their environment" (p. 8). They argue that there are two types of images of human nature, "one is determinism which gives the meaning controlled environment and voluntarism gives the meaning that free will and creativity" (Burrell & Morgan, as cited in Cohen et al. 2007, p. 8). In my research, all individuals have their own values. They are different in nature and they have their own environment for learning and existing. So, participants' perceptions and values were given more importance in my research.

Methods

The approach of my research is interpretive. "Qualitative (interpretive) studies are those in which the description of observations is not ordinarily expressed in quantitative terms" (Best & Kahn, 2007, p. 279). I included more descriptive forms of the information in my research. I used narrative inquiry as my research method. Creswell (2003) states "narrative research is a form of inquiry in which the researcher studies the lives of individuals and asks one or more individuals to provide

Employing Theories
I was trying to be a constructivist researcher but I could not neglect totally the views of behaviorist theory too. Though I took guidelines from my tutor to swim in the ocean of research, I had to swim myself in the depth My research was guided by interpretive research paradigm. Qualitative was the approach of my research study which I found rich in description.

stories about their lives" (p. 14). I included the research participants' views and experiences which I captured through in- depth interviews. Denzin and Lincoln (2005) state that narratives are socially constrained forms of action, socially situated performances, ways of acting in and making sense of the world (p. 641). Hence, narrative is understood as being part of a constructive process in which humans interpret and reinterpret their experiences according to a 'narrative structure'. As narrative method tries to connect phenomenon and infuse them with interpretation, I tried to see participants' interpretation of their experience and reconstruct and reconfigure past events through narration. Therefore, my participants' experiences and their views were the main sources of data.

Selection of Research Site and Participants

I chose six participants from some colleges and universities of Kathmandu valley to find out their experiences regarding my research problems. I found that conducting a research in a certain time period is a very challenging job and doing an in-depth study on the concerned topic is, yet another challenge. The nature of my research is interpretive in which I tried to include thick description of the information taken from participants. I took six participants so that I could bring in-depth information within the certain time period. Among six participants, five were from mathematics background and they were teaching

Choosing Participants
I decided to take six female teachers as my research participants. But I had no any idea how to get suitable participants according to the needs of my research. I talked with my tutor and he suggested me to find out a participant who was easier to contact. According to the needs of my research topic, I thought to take female participants who were teaching mathematics in higher level. I chose female teachers who were teaching mathematics in higher level so that I could capture their experiences as being mathematics student to teacher and they also could express their perceptions regarding low participation of girls in higher level mathematics education.

mathematics in higher level. I selected one participant beyond mathematics background whose major subject was Nepali in higher study. The reason of selecting a participant from different background was to capture possible causes behind her not selecting mathematics in her higher studies. People from different parts come to the capital of the country which is Kathmandu Valley for Nepal. I chose this place so that I could find my research participants having different socio-cultural and different geographical background of the country and my research could be more representative. To find out the participants from different corner of the valley, I used snowball sampling that made it easy to contact those participants who were totally unfamiliar to me before.

Conducting research with the whole group is almost difficult and sometimes it is impossible too. Therefore, the sampling made it possible within a relatively small portion of population. "The quality of a piece of research stands or falls not only by the appropriateness of methodology and instrumentation but also by the suitability of the sampling strategy that has been adopted" (Morrison, 1993; Cohen et al. 2007, p. 100). According to my research purpose, I chose snowball sampling because there were very few female mathematics teachers in higher level and they were far from my contact too. Regarding snowball sampling, Bryman (2008) states that the researcher makes initial contact with a small group of people who are relevant to the research topic then uses these, to establish contact with others (p. 184). Initially, I visited T. U. because it is the largest university

Interview: My Research Tool

For me, interview was the technique of data collection. Before going to the field, I developed some interview guidelines based on my research questions. Then I started to find out female teachers of higher level mathematics. I did not find any female mathematics teacher in my contact in KU. My previous one year study time in T. U. became fruitful at that time because I was familiar with a female mathematics teacher in T. U.

in the country and realizing that I would find more female teachers so that it would be easier to make contact with other female teachers as well. Coleman (1985) further states when the researcher needs to focus upon or to reflect relationships between people, tracing connections through snowball sampling may be a better approach than conventional probability sampling (as cited in Bryman, 2008, p. 185). Therefore, I found my participants' contact numbers from the help of the participants of T. U. Hence I did not face any problem to find out participants and it created very friendly environment.

Is it Like Snowball Sampling?
From my first visit with the participant, I took a list of contacts of more female teachers who were teaching higher mathematics education in different colleges and universities of Kathmandu valley. Whenever selecting the research site, I thought once to go beyond Kathmandu valley. At the same time, an idea clicked in my mind that there would be difficulty in finding out the participants according to my research purpose. So, I decided to stay in the Kathmandu valley to search my research participants.

Data Sources

There are two types of data sources which are used to gather data in any research work. I used primary data sources. Participants are my primary data sources in this research work. I used the following techniques to collect the data in my research study.

Interview

Interview was my primary data collection technique. "Interview is the process of interchanging view with one another. It is a flexible tool for data collection, enabling multi-sensory channels to be used; verbal, non-verbal, spoken and heard" (Cohen et al. 2008, p.349). In an interview, knowledge is created in between the point of view of the interviewer and the interviewee. (Kvale, 1996, p. 124). Further, Kavle (1996) says, "The qualitative interview is a uniquely sensitive and powerful method for capturing the experiences and lived meaning of the subjects' everyday world" (p. 70).

I used both unstructured and semi structured interview. “Unstructured interviewing tends to be very similar in character to a conversation” (Burgess, as cited as in Bryman, 2008, p. 438) and “in semi-structured interview, the researcher has a list of questions or fairly specific topics to be covered, often reflected to as an interview guide, but the interviewee has a great deal of leeway in how to reply” (Bryman, 2008, p. 438). In my research, I used just a few interview guidelines but mostly, interview was in the conversation form as it was unstructured. Semi structured and unstructured interviewing can be referred to collectively as in-depth interviews or qualitative interviews” (Bryman, 2008, p. 438). I used both semi-structured and unstructured interview with some interview guidelines. Taking interview with the participants, I realized that unstructured interview or conversation type interview is more effective to establish friendly environment with the participants and easy to generate the knowledge regarding related study. Participants feel comfortable to express their experiences, views and ideas in such friendly environment. I also believed that semi-structured interview provides right direction to the interviewer.

My research participants were university female teachers so I got rich ideas, experiences and information from them which were very important to my research purpose. Best and Kahn (2007) states that the purpose of open-ended interviewing is to find out what is in or on someone else’s mind not to put things in someone’s mind (p. 225). I learned many more things from the participants’ experience regarding my research problems. I visited participants through snowballing process. Initially, I visited Tribhuvan University where I spent a year for my academic life. So, I did not have difficulty in meeting participants and collecting the data. I got some contact numbers of the possible female participants from the mathematics lecturers/professors of T. U. With the help of my supervisor, I prepared some interview guidelines

according to my research purpose. Then I went to the field to collect relevant data through interview.

The participants were female lecturers of mathematics so I did not face any difficulties in the process of conversation because of their high understanding and logical capacity regarding research issues. It did not take long time to establish friendly environment between participants and me. I found them supportive and friendly. In the first round of interview, I spent around an hour talking with each participant. Interview was recorded in an audio device. Then, I started transcribing. After transcribing, I went through it to make some points. After this, I took second round interview to get more information. Again, I transcribed it and went through it. While transcribing and analyzing the themes after second round interview, somewhere I found little gaps and again took interview through telephone. Then after I found the saturation in the answers to my research questions and hence, I stopped taking the interviews.

Views of Science in My research

In my research, the view of science is complexity. Complexity science is the science of emergence (Heylighen, Cilliers & Gershenson, 2005, p. 11). It is known as context based science because it holds the theory of relativity and there is no master plan in research system. It is an agency oriented research approach. It has no objective structures. It tries to include all possibilities on the research process. While preparing everything from my side, I found a vast difference in the field with my participants. Though they had education, their journey of education from primary to master/doctoral level was vast different from the one I expected. Therefore, I used emergent theory which helped me to adjust myself with the participants' understanding or perceptions. Complexity science believes that every individual is

self-guided and capable of forming his/her perspectives. Thus in this research, participants were free to generate the knowledge through their experiences and understandings. So, there is interdependence of each organ of the body of my research.

Quality Standards

Quality standards are required to maintain trustworthiness and to provide quality in a research. Conventionally, a researcher needs to include internal validity, reliability and objectivity to maintain trustworthiness in a research. These words are approximately close to positivist research paradigm whereas I used interpretive research paradigm. So, to maintain the trustworthiness in my research, I heard participants' voice and I established myself deeply immersed in the research field. I tried to find out the actual data by conducting series of interviews regarding the same theme until I got the saturation of my research theme. I tried to bring out the ideas of the participants staying with them and interacting on the topic. To maintain trustworthiness in my research, the following concerns topics are used.

Credibility

Credibility is the criteria which talks about the idea of isomorphism between constructed realities of participants and those realities as represented by the researcher. There are several techniques for increasing the probability of such an isomorphism like; prolonged engagement, peer debriefing, negative case analysis, member checking and so on. Prolonged engagement technique is used to establish credibility in my research. I spent maximum time with the research participants to establish the relation between constructed realities of participants and my realities over the research. From the series of interviews with the participants I got the answers of my research questions. So, until I reached the saturation point of my research

questions, I tried to get more information from the participants (Guba & Lincoln, 1989).

Transferability

In my research, transferability represents the degree of similarity between researcher (sending) and readers' (receiver) context. To establish the transferability, I included thick description what participants said during the interview. Though the participants teach mathematics in the higher level now, they had painful experiences regarding their school education and college education. I tried to quote their words directly. This shows that participants and their experiences and views are more important to construct the transferability in this research study. So, I also tried to engage myself to interact with the participant to bring out the real data in my research (Guba & Lincoln, 1989).

Authenticity

Authenticity talks about fairness, beneficence, and so on. My research participants were unknown to me before this research study. But, I chose the participants from different cultural and geographical backgrounds to make my research more representative. I included all possible information that I got from the participants regarding the research issues that they expressed and shared during interviews (Guba & Lincoln, 1989).

Data Analysis and Interpretation

Data are the main part of my research study. I came to know that presenting data in the right way according to the demand of research questions is a challenging job. Creswell (2003) says, "Data analysis is an ongoing process involving continual reflection about the data, asking analytic questions and writing memos throughout the study" (p. 190). I collected all the data from the field through in-depth interviews with

the participants and then I transcribed them. After transcription, I went through them time and again and then I compared the ideas or views of the participants to organize them together. Then, I gave pseudo names for each participant like, Anita, Binita, Mahima, Kamala, Nabina and Sunita. Further, I tried to themetize the ideas under different headings. According to my research questions, I made nine possible themes from my data which I have mentioned in chapter three, four and five. On the basis of these themes, I began to analyze data in detail with the help of the literatures. I found the possible answers to my research questions from the themes.

Chapter Plan

I divided my study in six chapters according to their natures and importance of my research study. In Chapter One, I presented my research problem including brief context and practice of the study. On the basis of my personal experiences and background of the study, I generated my research questions. But I modified those questions after visiting the research field of this study as they emerged during the interview. Then, I designed the process of collecting data and chose suitable methodology for my research study. Likewise, Chapter Two helped me to explore more ideas on my research topic. Chapter Three included the answer to my research question (a). Chapter Four deals with the answer to my research question (b) whereas Chapter Five is about the answer to my research question (c). Chapter Six is a place for my reflections and summary of the study.

Further, the first chapter deals with the background of the study, statement of the problem, research question, rationale of the study and delimitation of the study which tried to set my research study and its scenario. Further, this chapter talks about the methodological approach and paradigmatic considerations including ontology, epistemology and axiology. It also talks about research methods including data

selection process and data sources. It also includes the quality standard and ethical considerations of my research.

Chapter Two deals with literatures related to this research study and feminism and constructivism as the theory of my research. Further, I included thematic reviews and some other related researches in this chapter. Similarly, it also deals with the socio-cultural dimensions of my research study where I talk about parental beliefs system, early marriage, and public image of mathematics and female teachers as role models for girl's education. Chapter Four talks about school mathematics pedagogy and its' influence on girls' higher level mathematics education. Chapter Five is a place to discuss the effectiveness of programs and policies on girls' higher level mathematics education. Finally, Chapter Six concludes my research study including conclusion, findings, my reflections and educational implications.

Ethical Considerations

Ethical issues arise in discussions about codes of professional conduct for researchers and in commentaries about ethical dilemmas and their potential solutions (Punch, as cited in Creswell, 2003). In the process of my research, initially I explained the purpose of my study to the participants to convince them. I convinced them that I would not put them at risk. My research participants had good understanding of the research so I did not face any problem while interviewing them. They also did not feel uncomfortable to talk about the research. I never tried to ask about their private information to make them feel embarrassed or uneasy. While analyzing the data obtained from the field, I tried to protect the privacy of the participants. I presented and interpreted the participants understanding, ideas and perceptions as they were expressed and shared.

Chapter Summary

I introduced the situation of how I passed my childhood and what differences I observed between me and other female students till now in the sense of getting opportunities of higher education. Then, I discussed the existing practices of female enrollment in higher level mathematics education including my experiences, colleges and universities and experience of my research participants. I came to know that there are different socio-cultural and pedagogical factors on the low participation of girls in higher level mathematics. Thus, I generated four research questions on the basis of problem statement. I included required methods and the process which I followed to complete my research work. My research is based on interpretive paradigm. Therefore, my whole research process is based on interpretive inquiry method. I tried to make my research work more trustworthy and ethical.

CHAPTER II

LITERATURE REVIEW

Literature review is one of the essential aspects for my research. Literature review in a research study provides the ideas with readers about the results of other studies that are closely related to the study being reported. Cooper (1998, as cited in Creswell, 2003, p. 210) suggests that literature review relates a study to the larger ongoing dialogue in the literature about a topic, filling in gaps and extending prior studies. It discusses published information in a particular subject's area and sometimes information in a particular subject's area within a certain time period. It provides us with a handy guide to a particular topic. In this section, I deal with relevant literatures related to my research study.

Literature Review: Connecting the Dots

Right from the beginning, it was difficult to connect the dots of literature with my experiences of being a mathematics student. At least I was able to connect the dots of the research background, methodology and data collection sections. How do I include the ideas of literature in my research? Mostly, I was thinking the same most of the time. This part seemed very isolated in the beginning of the research but later on I explored the importance of literature to substantiate my ideas further.

Defining Terminologies

I believe that meaning of any research depends upon the situation and context where it is located. So, I felt the essence of defining some terminologies which I include in my research study. I hope it will help the readers to make meaning of those words in my research study.

Female Participation

The word 'participation' refers to an act of sharing in the activities of a group. In my research, female participation primarily refers to enrollment and their presence in several spheres of mathematical learning in higher level mathematics education.

Higher Level Mathematics Education

In Nepal, higher education is the level of education after secondary education. After secondary education, there are bachelor degree, master degree and above (Shrestha et al. 1990, p. 68). In my study, higher level mathematics education indicates bachelor and masters degree in mathematics education.

Culture

Culture is defined as the distinctive patterns of ideas, beliefs and norms that characterize the way of life and relations of a society or group within a society (Koirala, 2003, p. 108). In my research, I tried to see the cultural influence on female participation in higher level mathematics education.

Gender Equality

In my study, geder equality means that girls/women and boys/men have equal conditions for realizing their full human rights and for contributing to, and benefiting from, economic, social, cultural and political development. It is the equal valuing by society of the similarities and differences of girls/women and boys/men, and the roles they play.

Gender Equity

Gender equity is the process of being fair to boys/men and girls/women. In my mind, to ensure fairness, measures must often be put in place to compensate for the existing historical and social disadvantages. Equity is a means, while equality and equitable outcomes are the results.

Stereotypes

I have come to know that stereotypes (related to gender or other aspects of difference) are ideas held by some people about members of particular groups, based solely on membership in that group. They can be positive or negative. Negative stereotyping statements reveal prejudice often resulting in discriminatory behaviours.

Thematic Review

According to my research purpose I searched for existing literatures from different resources which were supportive for my research study. According to my research questions, I went through different related materials for literature review that were on socio-cultural dimensions, school pedagogy and girls mathematics and programs and policies in girls' higher education.

What I Learnt?
I learnt the method of generating themes that are relevant to my research from the literature. In the same way I worked out to derive major themes that might be suitable for my dissertation. But I needed to wait until I got to the analysis section.

Socio-cultural Dimension in My Research

"Culture is defined as the distinctive patterns of ideas, beliefs and norms that characterize the way of life and relations of a society or group within a society. Sometimes, it is defined narrowly as 'custom' or 'tradition' and considered to be natural and unchangeable" (Koirala, 2003, p. 108). Nepali society is bound by different cultural belief systems. As a researcher, I tried to see the female's higher educational opportunities in comparison to males, especially in mathematics. Socio-cultural aspects of equity involve values, beliefs, and cultural traditions that are fundamental to the behavior of socio-cultural groups and government policies. "Culture is a very powerful means to construct knowledge. The early experience of mathematical learning has a longlasting effect in one's perception of matheamtics" (Belbase, 2006, p. 182). From the literature review, I

found socio-cultural barriers for the girls' higher level mathematics education like parental belief systems, early marriage, and public image of mathematics that is male dominated subject.

Parental Belief Systems

Parents are the key persons of the family and they have full rights and responsibility to direct the family members as well as their educational decision. In the context of Nepal, patriarchy has a great influence in the society and decision making process. In the society, a large numbers of parents are unaware of the importance of their daughters' education. They give more preference on sons' career and their higher education than that of their daughters. They believe that sons are the security of their old age and daughters are the subject of sending other's home. So, investing property on their education is valueless and unproductive for them. On the other hand, lacks of favorable environment, parents do not want to send their daughters out of the house. Sharma (2000) argues, "Lack of safe hostels in universities and colleges, parents are reluctant to send their daughter" (p. 183).

Early Marriage

In the context of Nepal, girls' marriage is more emphasized than their study and career. A research by UNICEF (2001) shows that in Nepal, there is the average age at first marriage is 19 years, 7 percent of girls are married before they are 10 years old and 40 percent by the time they are 15 (p. 4). Such marriage system of girls and the perception of family members towards the daughters and daugher-in-laws, many girls are unable to join higher study. They hardly complete the school eduation. But, still in rural areas, many girls are not getting chance of schooling due to early marriage. Although this theme is not directly related to my research, I envisage that early marriage could have impeded the higher education of girls.

Public Image of Mathematics

"The term image is defined as some kind of mental representation of something, originated from past experience as well as associated beliefs, attitudes and conceptions" (Sam, 1999, p. 12). I envisage that an image of mathematics is a mental representation which has been constructed through social interactional process. Sam (1999) further says, "It is claimed that to many people, mathematics is perceived as a difficult subject to learn and to teach. And mathematics and science have always been stereotyped as strongly 'male' or 'masculine" (p. 16). In this regard, Sam and Ernest (1998) say,

> It is a matter of concern that negative images of mathematics might be one of the factors that has led to decrease in student enrolment in mathematics and science as institutions of higher education, in the past decade or two… the term 'image of mathematics' refers to a mental picture, view or attitude towards mathematics, presumably developed as a result of social experiences, through school, parents, peers, mass media or other influences.

Society contains school as mini-society and schools are guided by different myths and perceptions existed in the society. Such myths are like, maths is difficult, it is just for clever one, maths is not enjoyable, not liked, boring, and it is not needed in life.

> The view that maths is difficult helps to support the belief that mathematics is an elite subject suitalble only for the most advantaged to study. So it is particularly noteworthy that it was by far the most important reason pupils gave for not continuing with mathematics (Povey, 2010, p. 2).

Here, I understood that there is a public image that mathematics is a hard subject and it is just for men. So, girls seem to be discouraged to study mathematics in higher level from such images of mathematics in the society.

As far as my experience is concerned, our society believes that mathematics is the male dominated subject. There is the perception that only a male can be a mathematics teacher and he can do better in mathematics than female. Gutbezahl, (1995) argues that some females' underachievement in mathematics might have related to the negative expectancies and attitudes of their parents, teachers and peers (as cited in Sam 1999, p. 58). While going through this sentence, I remember my past that my brother forced me not to study mathematics and to join the English course. So, to improve existing negative public image of mathematics, our contemporary practices of mathematics classroom also need to be improved.

The maths master, by L Haven Hill. *The Windsor Magazine* 1906

School Mathematics Pedagogy and Girls' Higher Level Mathematics Education

School education is the basic need of people. School mathematics curriculum could be presented as a more practical and useful subject to the daily life of students. However, due to gender insensitive and didactic method of teaching, school mathematics is being an abstract subject (Luitel, 2009; Poudel, 2010). "Learning is not like following a set route, with pupils building routinely on prior knowledge at many stages, learners may need to drop back a level to reinforce what they have learnt before" (Chambers, 2010, p. 99). In the context of Nepal, school mathematics depends on memorizing formulas and retaining mathematical patterns. So, I found the gap between mathematics and students' real life. The girls do not want to study until higher level. There is a public image that mathematics is just for male. Therefore, the

girls are reluctant to study mathematics in comparison to boys. As a result, there is a very low rate of enrollment of girls in higher mathematics education. A research study carried out by Pant (2009) shows that performance of boys is better than the performance of girls. Going through his research I came to know that the performance of private school students is better than the public school. Similarly, he shows that the performance of urban school students was far better than the performance of rural school students.

Because of shaky foundation of mathematics, many students do not want to continue their study in mathematics till higher level. "Mathematics is often described as a hierarchical subject where later learning depends on earlier concepts being grasped" (Chambers, 2010, p. 99). So, I understood that the basic concept is very essential to continue mathematics till higher level mathematics.

Policies and Program for Girls' Education in Nepal

Empowering girls through education in Nepal is being established as a great agenda in the sector of education. Government, I/NGOs and other types of educational institutions are launching different types of programs and policies in the sector of education. As I went through policy related review, I could not find any policy directly related to higher mathematics education. However, I thought that policy is always a general

Who Makes the Policies

While I went through different policies regarding girls' education, I found very limited provisions and programs regarding girl's higher education. I tried to find out the linkage between the policies on girls school mathematics education and girls' higher mathematics education. I tried to generate the ideas how policies and programs are helpful for the participation of girls in higher education. Who makes policies for female in higher education? Are few scholarships enough to increase the participation of female in higher education?

kind. So, I reviewed the reports of different educational plans like ARNEC, NESP and so on. Then I developed an understanding of policy dimensions of education from the perspectives of girls' education.

I have found that the Ministry of Women and Social Welfare (MoWSW) was founded in September 1995 after the global women's conference in Beijing. MoWSW is responsible for facilitating a partnership between line ministries that will result in cohesive, high-impact delivery of a national action plan for girls' and women's empowerment (Pennells, 1998, p. 4). I have found that *Cheli-beti* Program for girls who do not go to school, launched in 1981, is considered as one of Asia's leading success stories in girls' empowerment. Basic and Primary Education Project (BPEP) was launched in 1991 to provide the basic and primary education to the children. The first Phase of BPEP ended in 1997 and BPEP Phase second was expanded and it focused on hostel accomodation for remote area girls to take teacher training. Annual scholarships of Rs. 250 are designed to help economically disadvantaged girls in 65 districts and all girls in the remaining 10 most educationally disadvantaged districts to attend school (Pannells, 1998, p. 6).

How to Report?

While writing this section, I was in a dilemma thinking how I express better to show the emergence of research. Had I to use the first person pronoun? Or was it better to use Third person? What about the use of tense- present and past? Mostly I read dissertations written in the third person and past tense, but I think these linear writing processes might not fit here.

Similarly, the All Round National Education Committee (ARNEC) – 1961 recommended establishing residential schools for both boys and girls for the expansion of education (Bist, 2006). In National Education System Plan (NESP) – 1971 the government launched the Equal Access of Women to Education Project (EAWEP) with the purpose of increasing girl's participation in education through the

production and recruitment of female teachers. The Fifth Five Year Plan (1975 – 1980) stated that women should be recruited as teachers in primary schools in order to expand girls' enrollment. The Sixth Five Year Plan (1980 – 85) emphasized the need for recruitment of female teachers to promote girls' education in the country. In the report of National Education Commission (NEC) – 1992, the commission advised the government to give urgent priority to basic and primary education. It also recommended that there should be at least one female teacher in primary level. The Eighth Five Year Plan (1992 – 97) adapted many of the recommendations and policy measures suggested by the National Education Commission and the Basic and Primary Master Plan of 1991. The plan targeted to achieve a net enrollment ratio (NER) of 90% for children in the age group of 6 to 10. The Ninth Plan (1997 – 2002) gave emphasis to increase equal participation of the deprived, remote and backward communities in basic and primary education. I came to understand that the report of the High Level National Education Commission (HLNEC, 1999) recommended that there must be female teachers in each pre-primary, primary and secondary school. Further, the commission advised the government to extend this policy to higher secondary schools and universities as well. It also emphasized that females should be appointed in positions of educational leadership. Similarly, the Tenth Plan (2002 – 2007) laid emphasis on gender mainstreaming and social inclusion. It seeks to ensure equal access to quality basic education irrespective of gender caste or ethnicity (Bist, 2006).

As per my review, Education for All (EFA, 2004 – 2009) can be regarded as a successor of Basic and Primary Education Program II. I came to know that this program has adopted the six Dakar goals of expanding and improving early childhood development ensuring access to education for all children meeting the learning needs

of children including indigenous people and linguistic minorities reducing adult literacy, eliminating gender disparity and improving all aspects of quality education. Millennium Development Goals (MDG) set a goal to promote gender equality and empower women. It targeted to eliminate gender disparity in primary and secondary education, preferably by 2005 and in all levels of education no later than 2015 (MDG, 2010).

According to the Population Census (2001), male and female populations are 49% and 51% respectively. But I knew that in the case of education, it is just the reverse. Girls are far behind than boys in education. Boys' literacy rate is 65% and girls' only 42% (CBS, 2001 as cited as in CERID, 2006). From this study, I understood that female participation is lower than male in education. The government has formulated specific policies for the promotion of girls' education. I came to know that most of the policy efforts are focused on primary education whereas my research looks into the participation of girls in higher level mathematics education. It is in this gap I have discussed my analysis (see Chapter Five)

Theoretical Review

I used feminism and constructivism as theories in my research study. I have used feminism as an analytic interpretive tool as it studies the gender relations in education and in the community.

Feminism

My research topic focuses on women's higher education. Education is taken as a backbone of the nation. Every citizen needs to be educated to develop the country. My research issue raises the voice on empowering girls in education. One of the objectives of higher education in Nepal is to produce skilled manpower for the nation. Females cover more than 50% of whole population of the country. But while visiting

different universities and colleges in Kathmandu valley I found only around 10% females participating in higher level mathematics education. This is very low in comparison to the male participation.

The patriarchy seems to have a great influence in the context of Nepal. Especially, father, brother and other male members of the family seem to have key role in decision making process. Our society seems to give more preference to the male. The parents are largely unaware about the advantages of daughters' education. So, they focus on daughters' marriage rather than their study and career. Due to lack of time and social boundaries, they cannot continue their study after marriage.

Am I a Feminist Researcher?
Though the origin of feminism is based on Western society, I realized that feminism is helpful for Nepali society too. In the context of Nepal, a large mass of women seems to be limited inside the house and are busy in household works. I believe that development of the country is not almost impossible until and unless every citizen are educated and highly skillful. Am I a feminist?

Feminism seems to start from the view that women are oppressed and that for many, this oppression is primary. Feminist argue that women's freedom of action is limited by the power of men because men possess more economic, cultural and social resources than women (Abbott & Wallace, 1997). "A feminist believes that women suffer discrimination because of their sex, that they have specific needs that remain neglected and unsatisfied, and that the satisfaction of these needs would require a radical change in the social, economic and political order" (Delmar, as cited in Turner, 1995, p. 3). Feminism is clearly not a unitary movement. Though there is a basic desire for equality and the end of discrimination, there are many feminist groups including radical feminists, socialist feminists, Marxist feminists, lesbian separatists, women or color, postmodern feminists, feminist empiricists and so on; all of them

have a different definition and viewpoint. On the whole, “Feminism is an active desire to change women’s position in society” (Mitchell, as cited in Turner, 1995, p. 3).

When I went through a book “An Introduction to Sociology: Feminist Perspectives” by Abbott and Wallace (1997), I came to know that there are seven feminist perspectives: (1) Liberal feminists believe in immediate struggle against discrimination against women. They suggest legal and other reforms in this connection, (2) Marxist feminists flout women’s oppression in public production, (3) Radical feminists point out male’s control over females and suggest fight for female freedom, (4) Materialist feminist, argue that, being a social class, women are exploited, they are subordinated by men, (5) Dual-systems feminists assert that women’s oppression is an aspect both of capitalism and patriarchal relations, (6) Post-modernists say that discourse from a woman’s point of view is lacking, and (7) Black feminist’s perspective on gender is the liberation of Black people, including women.

In my research study, socio-cultural dimensions seem to have the great influence on low participation of girls in higher level mathematics education. Earlier studies show that parents believe that girls need to learn how to do household works and study is not their primary essence (Shrestha et al. 1990; Sharma, 2000). They also believe that only primary education is sufficient for girls. Girls also do not seem to be free to choose the subjects according to their interest. Society believes that mathematics is a hard subject and only male can do better in mathematics. From these scenarios, I analyzed that girls are treated differently than boys for the access of higher education and other education. So, I

Common Themes
I picked out some common themes of feminism and tried to look from the Nepalese perspective of feminism in a straightforward way.
According to the common themes of feminism, I felt that feminism can play a key role to empower women in development sector like education, decision making position and other positions in the society. So, I tried to introduce feminism briefly in my research work.

thought feminism might be the guiding theory of my research. I went through different kind of feminism briefly but I felt that my research study is guided by radical and liberal feminism to some extent. Liberal feminists argue for access to current educational structures, whereas radical feminists argue that men dominate women through violence, the educational system is flawed, and entirely new systems are needed. I came to know feminism itself is taken as a critical theory but I used it as an analytic interpretive tool.

Constructivism

Constructivist theorists, in general, believe in construction of knowledge by participants being engaged in the activities. They believe that children are not like the black box as behaviorists assume but they come with some prior knowledge constructed by them. "Constructivism is founded on Piaget's belief that learning is an active process, where new information is accomodated into previously understood meanings or mental images" (Chambers, 2010, p. 101). On the other hand "Behaviorist theories of learning emphasize the effect of punishment and rewards in learning and assume that students are like black box" (Chambers, 2010, p. 99).

When I went through an article 'A Synthesis of Different Psychological Learning Theories by Dahl (n. d.), I came to know the difference between Piaget's and Vygotsky's constructivism. I tried to understand Vygotsky's constructivism because according to my research purpose I tried to focus more on social-cultural dimensions and its influence on girls' higher mathematics. Vygotsky's constructivism also called social constructivism, focuses on social and cultural environment of learning which has a vital role on the learning process.

In this research study, I am trying to be a qualitative-interpretive researcher. As such, I tried to make my research study rich in description and try to give more

emphasis on relative truth, participants' context and understanding. Ernest (1991) argues, "social constructivism views matheamatics as a social construction" (p. 42) and "identify mathematics as a social institution, resulting from human problem posing and solving" (Ernest, 1991, p. 281). My research study has focused on socio-cultural dimension of girls' higher education. I believe that every educational institution is a part of society. So, every member of the society is guided by social norms and values. According to them, an individual creates knowledge according to their understanding and social activities. Constructivist theory of learning in qualitative research believes that there is not a single truth; rather all truth is relative and constructed by the individual or society. So, as a researcher, I engaged in interaction with participants to get the ideas on my research topic. Similarly, participants generated the knowledge and meaning from their experiences and their ideas regarding the research topic.

Review of Related Research Studies

A research study carried out by Parajuli and Acharya (2008) entitled, 'Measuring Gender Equality in Education' shows that girls are still facing discrimination in accessing schools. They also said such restrictions towards women were also clear in participating in teaching and in school governance and management. These realities suggest that fresh strategies are required, along with present interventions, to achieve gender equality in education as per EFA and MDG. These fresh strategies however should focus on equity perspective and should be local ethnic and other context specific.

State of Confusion
Confusion everywhere
Though I went through different literatures, I was more confused as I read more. Such as:
Difficult to choose literature, difficult to incorporate ideas difficult to adopt new ideas.

Perhaps, confusion leads to fusions of ideas. I don't know for sure.

I came to know that Sharma (2000) in her research study entitled, 'Female Participation in Technical Education in Nepal' found that participation of women in higher education is low. Few females participate in decision making and management in higher education. Although the number of women participating in public life has increased, it is only occurring in areas of traditional female employment and at the lower level of the occupational ladder.

Started with Research Questions

To address my first research questions, I went through the literatures based on socio-cultural dimensions and girls' higher education. I found many researches based on girls' primary and school education. I got very few literatures based on women's higher education. So, I felt difficulties to generate the exact ideas on my research problems.

Bista (2004) reviewed research literature on girls' education in Nepal that was conducted during the period of 1990–2004. The 20 studies reviewed for this purpose covered four areas of girls' education, namely: (a) role of women teachers in education (b) scholarship and incentive program for the promotion of girls' education (c) gender disparity in education, and (d) barriers to girls' education. The review, at the same time, also identified socio-cultural values, economic hardships of the parents, conflict-triggered constraints, family circumstance of girls, and poor teaching-learning environment in schools as barriers to girls' education. It has also mentioned the measures suggested by different studies. Some of the measures call for reorientation of teachers, increased support to girls and female teachers, and the parental motivation program. This shows that there is lack of friendly environment for girls in the field of education because of the parents' and teachers' motivation, lack of women teachers and so on.

A research study by Walkerdine (1989) indicates that there is overwhelming evidence that the proportions of females passing mathematics examinations at 16 and 18 years of age in Britain is less than that of males and that the proportion of males at

the higher grades. Further, Walkerdine argues that the powers of rationality and mathematical thinking are so bound up with the cultural definition of masculinity and that the discursive production of femininity is antithetical to masculine rationality to such an extent that femininity is equated to poor performance, even when the girl or women is performing well (Walkerdine, as cited in Ernest, 1991).

Furteher, Sharma (2000) found in her research study entitled 'Women Participation in Technical Education in Nepal' that socially, culturally and religiously, females are pressured to take care of the husband and family. The parental house is a temporary home for females. Therefore, parents prefer to get their daughters married off rather than support her career. After marriage, performing the daul role of mother/wife and student it would be difficult for them to manage time.

A research study by Shreshtha, Pradhan, Ghimire and Singh (1990) indicates that the majority of female campus stuedents (87%) expressed their intension of pursuing further studies. The prime factors prompting them to pursue higher levels of education were socio-economic ones. Further they found that since parents themselves are not educated they do not realize the importance of education for their children. Moreover, most of the rural parents living under subsistence level simply can not afford tuition fees for their off-spring.

A study carried out by UNESCO (2006) entitled 'The Impact of Women Teachers in Girls' Education' shows that there is a positive correlation between women teachers and girls education. A female role model can support and encourage girls to successfully complete their studies. But due to lack of role model, many girls are not allowed to go the universities and colleges, and even to schools especially in the rural areas.

A research study by Lim and Ernest (1998) shows that negative public images of matheamtics might be one of the factors that has led to the decrease in student enrollement in mathematics and science at institutions of higher education. Further they argue that mathematics is taken as a subject of male concern, a hard subject and just for a clever one. This study shows that due to social belief systems that matheamtics is a male dominated subject, girls are discouraged to choose mathematics in their higher study.

I have come to know that this issue has been very important to the so-called developed countries too. American Association of University Women (1992) showed that girls' self-esteem, confidence in their abilities, expectations for life, interest in challenging courses and rewarding careers and pursuits in math and science decline as they get older. Teachers may contribute to girls' problem by giving them less attention or a lower quality of attention during class, therefore teachers must be careful not to limit girl's potential in math and science by using gender - biased practices. Especially during math instruction, teacher must be sure to call on girls for asking answers to questions and give them praise when the answers are appropriate (Chand, 2008). From Chand's research it seems that one cause of low participation of girls in higher level mathematics may be the lack of teacher's care to the girls' mathematical learning process. Still the myth that mathematics is male dominated subject is blooming in our society.

In a research carried out by U. S. Department of Education (USDE) (1997) entitled 'Women in Mathematics and Science' suggests that while women are just as likely as men to go to college immediately after high school, from the start they are less interested in majoring in mathematics and science. Although women tend to major in different subjects than men in college, some of these differences have

narrowed over time. The mathematics and science fields continue to be areas where the gender gap remains large. Women are far less likely than men to earn bachelor's degrees in computer science, engineering, physical sciences, or mathematics.

A study by Brock and Cammish (1993) show that a major deterrent to female take up and follow through of educational opportunities (even when these are available) is a near universal fundamental cultural bias in a favor of males. The widespread operation of patriarchal systems of social organization; of customary early marriage; of the incidence of early pregnancy, of heavier domestic and subsistence duties of females; a generally lower regard for the value of female life, all combine though differentially in each case, to adversely affect the participation of girls and women in formal education.

In a research study, Gill and Judish (as cited in Chand 2008, p. 20) indicate that middle school and high school girls have positive attitudes toward school but negative attitudes towards mathematics. It focuses on the gendering- the separation of boys and girls- of Australian schools through the study of 7^{th}, 8^{th} and 10^{th} graders in coeducational programs as well as girls only schools. Despite some authors' belief that separating boys and girls for math improves girls attitudes towards math, the result indicates that even when girls are taught in all girls schools, they still have negative attitudes towards math. With regard to teachers, the paper suggests that separating boys and girls during math's instruction does not improve girls' attitudes towards math.

Similarly, Spencer (1999) argues that women are high attrition from quantitative fields, especially maths, engineering, and the physical sciences, where their college attrition rate is 2½ times that of men. As some point, continuously facing stereotype threat in these domains, women may misidentify with them and seek other

domains on which to base their identity and esteem. While other factors surely contribute to this process, gender-role orientation, lack of role models, and differential treatment of males and females prevail in schools. It can be said that stereotype threat may be an underappreciated source of these pattern. He indicates that the stereotype threat that woman experience in math-related subjects may cause them to feel that they do not belong to math classes.

Swetman (as cited in Chand 2008, p. 22) showed in his study that girls' positive attitude towards mathematics decline as they grow older. Initially girls have more positive attitudes towards mathematics than boys have but as they continue in school, girls' attitudes become more negative. In order to improve girls' performance in math, teachers need to facilitate positive attitudes in girls towards mathematics. In the research entitled 'Girls in Science and Technology: A study on 'Access, Participation and Performance of Gilrs in Nepal' by Koirala and Acharya (2005), girls were identified to have found algebraic formulae and geometry more difficult and hence obtained low scores than boys. From that study I also came to know that girls in Terai were low scorers in mathematics among the students.

In this way, despite the formal assurance of equal access to education, in practice, outcomes for males and females in academic achievement, personal development and employment opportunities are different. Therefore, much remains to be done, so that the gap between men and women is bridged and the true spirit of equality between them is appreciated, accepted and observed (Bingham & Martin, as cited in Sharma, 2000).

An article by ERIC (2002) shows that the physical environment of the classroom should be interesting and inviting for all students. The classroom should display student works and other materials that show a diverse group of people

involved in mathematics activities and careers. The classroom arragement should allow all members of the class to participate in mathematics activities regardless of their current achievement levels.

Halpern (2004) argues that early experience, biological factors, educational policy, and cultural context affect the number of women and men who pursue advanced study in science and maths and that these effects add and interact in complex ways. There are no single or simple answers to the complex questions about sex differences in science and mathematics.

A research study by Pant (2009) shows that the girls score less in mathematics than the boys. The major reasons are less participation of girls in classroom, working more at home, difficulties in the process of socialization for girls and due to the physical problems of the girls during the adolescense period. There was a strong belief that mathematics can not be learnt by girls. There are no more female mathematician and mathematics teachers. The psychological effect was also one of the causes that lead the girls towards the low achievement in mathematics

A research study conducted by Sharma (2000) also shows that socially and culturally, females are not given freedom of mobility. Boys are allowed to go outside the house any time, even away from home for their education, but most parents still do not allow females to go out of the home alone. The cultural rationalization is also supported also by religion, is that a son is required to perform the last rites of parents when they are dead, parents who do not get these ritual services for want of a son do not receive salvation (Shrestha et al. 1990). This shows that parents provide more preference economically and culturally to their male child than their female child. Such a cultural beliefs create discrimination towards female education in the family.

In many cases, parents are not in a position to send their children away for schooling, for their services are needed at home. And under such circumstances, if they do send their children to school they generally prefer the boys to go for they carry on the family tree and , according to superstition, bring salvation to their parents after death. Since daughters are married away, investment in their education is considered to be a loss. Social norms and cultural values also devalue higher education for females; they are supposed to confine their activities to the home only (Shrestha et al., 1990).

A research study by Shrestha et al. (1990) indicates that the provision of scholarship for girls and cash awards and medals to the schools which enrollment the highest number of girl students are some of the measures being undertaken to attract larger numbers of girls to schools. Almost all students aspire to pursue higher education, but due to socio-economic conditions and conservative values, like early marriage and household responsibilities, girls are compelled to discontinue their studies.

Further, Bist (2006) reviewed literatures in girls education in Nepal and found on his study that girls are believed to be less able to learn maths and science as compared to the boys in school level. Also they are shy and nervous to ask questions in the classroom, which could be one reason for their poor performance as compared with boys.Teachers' negative expectations and attitudes undermine girls' confidence and performance in subjects like Math, English and Science. Further, in a research by UNESCO initiated study (Koirala & Acharya, 2005) found that Nepelese girls achievement in school mathematics is consistently below that of boys. A major contributing factor was found to be teacher's gender stereotyping views of girls'

future social roles as home-makers rather than as prospective workers or professionals.

Research Gap

I went through many related materials and theses for literature review regarding girls' education. I found several studies regarding girls' school education however, I found only few studies on female's higher education. Moreover, all the researches focus only on finding factors influencing female's higher education but they are unable to explore ideas on how different factors influence female's participation in higher education. My research study tried to explore the ideas on how socio-cultural and pedagogical factors influence on girls' higher mathematics education. Further, it tries to explore the ideas on how policies and programs are helpful for their participation in higher level matheamtics education. So, my research will contribute to fill the gap between female and higher level mathematics education exploring the ideas on socio-cultural and pedagogical dimensions.

Chapter Summary

In this chapter, I reviewed different literatures related to my research issues. I went through different literatures regarding socio-cultural dimension on girls' higher education. Similarly, I went through the literatures concerning school mathematics pedagogy and girls' educational programs and policies.

CHAPTER III

SOCIO-CULTURAL DIMENSIONS

Chapter Overview

This chapter deals with various forms of socio-cultural practices that create discrimination between men and women in higher education. Being a mathematics student, I have focused in this chapter on mathematics education. The answer to my principal research question is scattered within the third, fourth and fifth chapters. In this chapter, I have tried to address my research question: 'How do socio-cultural dimensions influence the participation of girls in higher level mathematics education'? I have also tried to incorporate different forms of socio-cultural dimensions through interacting with the participants regarding girls' higher mathematics education. This chapter ends with the conclusion.

My First Field Visit
I visited five participants and spent around 45 minutes with each participant. I came to understand that I would get rich data from the participants for my research. They were cooperative too. I engaged in the insightful conversation. First interview was fruitful for me because I was in a process of connecting the dots of literature review and my experience of being a female mathematics student. This time, I grasped the values of lived experiences of my participants to generate new knowledge.

Socio-cultural norms and practices have a huge impact on everyday forms of discriminations against women. UNESCO (2002) states, "cultural and social beliefs, attitudes and practices prevent girls from benefiting educational opportunities to the same extent as boys" (p. 21). The culture of preference to sons is translated in thinking that sons remain in the family and are expected to support parents in their old age, whereas daughters marry, normally in their mid to late teens, and become

members of another family. Brock and Cammish (1993) state "a major deterrent to female take up and follow through of educational opportunities is a near universal fundamental cultural bias in favor of males" (p. 13). The patriarchal social structures, girls' early marriage and early pregnancy, motherhood duties and household works affect the participation of girls and women in formal education. The purpose of my research is to find out the causes of low participation of female in higher level mathematics and socio-cultural dimensions' influence on it. Being a female and having recently completed my master degree classes in mathematics education, I have a series of experiences of girls' low participation in mathematics classroom from class nine to master's degree which I have mentioned in the beginning paragraphs of Chapter One. Here, I have included participants' views also on the concerning topic; Female participation in higher level mathematics education and socio-cultural influences on it.

Birth of the Last Participant

After some interviews at the first round, I started to transcribe the conversation. From five participants, I found parallel views and experiences regarding low participation of girls in higher level mathematics education. I thought to encompass diverse views of the participants or in-depth analysis of the female participation in higher education. I selected sixth participant who majored Nepali so as to capture the reasons why she did not choose mathematics as her major subject in higher study.

Parental Belief Systems and Girls' Higher Education

Parmar, Harkness and Super (2004) state, "Parents' cultural belief system influences on the organization of children's environments of learning and development" (p. 51). In the society with strong family values, parents are the key persons of a family. Whatever they decide about their children becomes applicable to their children. So, their understandings and education level is likely to influence their children's learning and development process. Unsurprisingly, Nepali society is much more influenced by

patriarchal system in which the men decide everything and the women and rest of the family members listen or accept it as an order. Manu (translated by Buhler, 1886) states that women must be honored and adorned by their fathers, brothers, husbands and brother-in-laws who desire their own welfare (p. 41). Can these honors be taken as making women stay within the desire of men? To me, it is not uncommon in our society that father decides who should go to school and college and who should not. Neither children's voices are heard nor are they allowed to present opinions, especially if they are girls. So, it can be said that daughter's education is also guided by her father at home. Along this line, Anita said:

> "*When I completed grade five, my father said, "As a daughter, you have taken basic education. It will help you for reading and writing letters in future. You will stay in this home one or two years, and then you will get married and have to go others home. If so, why to read more? Now you stay at home looking goats and cutting grass for them. It will support your mum and home as well. Fortunately I am here in this university as a lecturer now" (May 16th, 2011).*

As a female researcher, these statements made me sad because I had not expected such experiences from her and thought about the rest of the females, who could not get chance to complete even their school education. I can infer that many other females are likely to have the same experiences like Anita. Even if they got chances to study higher education, they would not be free to choose the subjects according to their interests. They were guided by their brother, father and husband if they are married. Of course, parents are becoming more conscious regarding daughter's education but a huge mass has still negative impact towards daughter's education (UNESCO, 2006). Further, Binita said in her interview:

> *"I haven't faced any parental negative attitudes regarding my study because my father himself is a teacher but the huge mass is different. Still parents do not have positive response towards their female children's higher education" (May 18th, 2011).*

Binita's experience regarding her education is different from Anita. She got the chance to study easily till higher level because her father seemed to be educated and aware of daughter's education. It shows that parents' good academic background has the greatest impact on daughters' education as educated parents can understand the value of girls' education. Unlike this, Kamala's opinion made me reflect on the nature of parental thinking prevailing in our society:

> "*Parents believe that basic education is sufficient for girls. They think that marriage of daughter is their greater responsibility than their study. That's why parents focused only on girl's household work rather than study" (May 19th, 2011).*

This statement indicates that parents do not give more priority to daughter's higher study than their son's. They think that basic education is sufficient for daughter and household works are more preferable. UNICEF (2001) shows that although attitudes towards the education of girls have begun to change even in traditional societies, many parents still believe that investment in a girl's education is wasted when she is simply going to be married and work in another household. Next participant Mahima added her opinions;

> *"I am from Terai belt. Early marriage is the feature of Terai. I was nearly married off when I was in grade seven. Not only my parents but also lots of parents think that if money is invested on daughter's education especially higher education then how to arrange dowry for her marriage? That's why; to*

invest money on daughter's education is unproductive and valueless" (May 22nd, 2011).

These statements help me to realize that parents have the fear of daughter's dowry system for their marriage and they do not want to invest money to make their daughters educated. Indeed, this situation reminds me of Arundhati Roy's (1997) writings which critique the commodification of women. Similarly, the parents think that investing money on girls' education is just the waste of money and daughters are the matter of sending others' house. Further, Nabina said:

"Our social structure is male dominated. Parents think that daughters are the matter of sending other's home. So, she should know how to do household work and how to serve her family members. She should focus on household work rather than her study" (May 25th, 2011).

Considering a family as a unit of a society it is influenced by the social norms and values, and it also influences the society. Due to the system of patriarchy in Nepal, male members of the family have the power to guide their family. While the social belief systems and power structure favor males, females' education is not preferable in comparison to males. So females' household works are given more importance than their study. Sunita said,

"Parents think that daughter is a matter of sending to other's home and daughter in law (Buhari in Nepali) is a person for household work but not for study. They have the concept that basic education is sufficient for them and higher education is not necessary for them. For example, parents send their sons abroad for study but they do not want to send their daughters and daughter-in-laws to the colleges of Nepal for their higher study. They also

send their sons to good private schools but send their daughters in government or community schools" (May, 31st, 2011).

The stories of the participants and my own experiences portray the same phenomenon that sons are more preferred to daughters. The Himalayan Times (July 26th, 2011) refers to a recently published Department of Education report showing the lower number of girl students in private schools than that of boys, while in community schools, girls' number is more than the boys. Parents are guided by the beliefs that their sons should be admitted to private schools whereas girls' place is public schools. Thus, it has deprived many girls of having quality education as generally held perception is that private schooling has been better than public schooling in terms of quality learning environment and prospects of further study.

Early Marriage and Girls' Higher Level Mathematics Education

Within 45 minutes with each one of my participants, I became surprised to see the emergence of many cases. They expressed their experiences of school and higher education without any hesitations. Though they are in high rank at present among all the females of the country, they had painful journey of education till higher education. They had faced more additional challenges and obstacles on reading mathematics till higher education. The low value attached to girls' education reinforces early marriage and vice-versa. In Nepal, 40% of girls are married by the age of 15. Too often, marriage is seen as a high priority than education (UNESCO, 2002, p. 21). Early marriage, early pregnancy and motherhood responsibility, household work and duties are other aspects for the girls which deprived them of getting the higher education. Anita said:

"It's difficult to manage career and household works for a girl after marriage. It is difficult to manage the time for study and other responsibilities at the same time too. Though there are sufficient voices of gender equality and equity, there are very few cases that husband helps his wife in household work. Now I am a jobholder. For me, it's difficult to manage time for study, childcare and household work. It's really challenging for girls to manage the time after marriage" (May 16th, 2011).

Male vs. Female Construction
I was surprised in many cases while talking to my research participants. I found in the center while listening to their perceptions and understating of the female student and teachers that they had painful journey of education. And so did I. I imagined that these challenges would not occur if we were 'Male'. Has it been an inclusive development of the higher education system or is the similar male formed structure prevails in the community? I am mostly thinking on the privileges that male students get. Is there justice for female students in the higher education?

From Anita's opinion, it shows that marriage and time factor are directly related to each other. Due to lack of time and household work, females cannot continue their study after marriage. It can be said that if girls did not get married till the completion of their higher study then it would be easy to develop their career and continue their study as well. Otherwise, they need to play double role as being student and housewife at the same time which is very difficult for the women. Similarly next participant Binita said:

"People think that study is not essential after marriage. We know that female has double responsibility after marriage. She has to care her family members, children and household work and so on. Thus it is difficult for her to manage time for study. That's why many girls cannot continue their study after marriage. If some girls get chance to study after marriage, it's very difficult for them to manage time for study. But their strong commitment may help to

complete their study together with household works and other responsibilities too." (May 18th, 2011).

According to Binita, it is a challenge to manage time and good environment for the study after marriage. Further, she expressed her opinion like "If there is a will, there is way (Nepali proverb: Jaha ichchha, tyaha upaya)". It shows that every person needs to have desire, commitment and devotion for the learning. In the same way if a female wants to study after marriage, then she can manage time but family needs to be supportive and positive to her study and career. Kamala said:

"Daughter is taken as an object of sending other's house. After marriage, girls have to face family domination and she cannot do anything without family permission. Next thing she has to play double role as a housewife and as a job holder. If she has a husband having good understanding regarding her study and career, then she can do further for her career. Also, after marriage, a girl has motherhood responsibility too. If her family is not supportive then female has difficulties to develop her career and give cares to her children at the same time" (May 19th, 2011).

It shows that the girls seem to follow the rules of their husband and other family members after marriage. If she has a supportive husband on household work and career, it can be easier for her to continue her study and can develop her career too. But due to lack of time, it seems that to study mathematics is difficult for almost all the females till higher level. Mahima shared her idea in such a way:

"When I was in grade seven, parents forced me a lot for marriage. Fortunately, I got the chance to study till intermediate level. If I was married at grade seven, I would not get chance to study SLC level either. Mathematics is a time consuming subject. But after marriage it is difficult to manage time

for study due to household responsibility. Next thing there is also child care responsibility. That's why it is difficult to continue study after marriage" (May 22nd, 2011).

This statement shows that when girls are in their school age, most of them have fear of marriage. Fortunately, some girls get chance to study till SLC. The tradition seems that parents start to search the candidate for her marriage. After marriage, girls seem to face many problems like, family preventions and restriction, pressure of the household works and so on. So, they are forced to drop out the study and have to prioritize the household work, husband care, child care rather than their own study. Next participant Nabina added her opinion on the concerned topic as:

"Early marriage is a problem for low participation of girls in higher level study. Though I got married in matured and capable age, I could not get support from my husband in my household work. We both, I and my husband, are involved in job. Whenever my husband comes from the office, he says that he is tired and he sits on a chair. But I have to do all the household work and have to prepare the subject matter which I have to teach in class. So after marriage, it is difficult to manage time for study for a woman" (May 25th, 2011).

Though both husband and wife are capable and educated, females are engaged themselves more in household work and child caring than their male counterpart. This could be a key reason why females cannot develop their career properly and cannot continue their study. Because of environment at home after marriage, girls can not develop their personality and professional life. Sunita said;

"People think that daughter in laws (Buhari in Nepali) should not go out from home for study and job. They should not talk with strangers especially males

and they are just for household work. That's why parents do not want to send their daughter in laws to college and working place after marriage. Before 10 years, I got married when I was doing my masters. My family members were conservative though they seemed open minded. After that they did not send me to college and I left my job too. My mother-in-law and father-in-law used to shout at me when I used to take rest just for a few minutes. They used to say; "There is no culture for daughter in laws to get food without working in our family". (In Nepali; Hamroma buharile kaam nageri khana paune chalan chhiana). I used to be busy only on household work and I didn't get a single minute for my study. So, I did not complete my masters' at that time" (may 31st, 2011).

Let me cite Manu (1500 B C translated by Buhler, 1886) who states, "Women must always be cheerful, clever in the management of her household affairs, careful in cleaning her utensils, and economical in expenditure (p.45). The prescription made by Manu has negative consequences as males and females are judged on the basis of such a differing frameworks. Carrying with such discriminatory experiences how a girl could continue her study. So, after marriage, study and career are very far issues for them. They are not free to do whatever they want and have to get permission in each and every steps of their interest.

Public Image of Mathematics and Girl's Higher Level Mathematics Education

The term of 'image' is defined as some kind of mental representation (not necessarily visual) of something, organized from past experience as well as associated beliefs, attitudes and conceptions (Sam, 1999). In the context of my analysis images of mathematics can be understood as mental representations or views of mathematics constructed as a result of social experiences including school, parents, peers,

textbooks and other resources. I came to know through Ernest (as cited in Sam, 1999) that many people's images of mathematics represent mathematics negatively via the metaphors of mathematics as cold, abstract, and in many cultures, largely masculine discipline. For my study, I talked to the participants. From their opinions I found there is the social image that mathematics is a difficult subject which is only for intelligent one. It is also male dominated subject. While talking about the female and higher level mathematics education with my participants, Anita said;

I am Sure to be Contextual
I was afraid of previous research works that hardly contextualize the participation of female in higher education. I tried to overcome such obstacles and challenges based on socio-cultural pedagogical and policies regarding girls higher education to make it contextual. Listening to my participants, I felt that my research topic is really context based and I realized more research should be done on women higher mathematics education.

> *"Till now, there are a very few ladies who have get higher education in mathematics. More teachers are male. When I got problem in mathematics, I used to go to the teacher. So, I faced many unnecessary blames due to bad social belief system. Whenever I entered grade nine, even my teachers including head teacher also suggested me not to choose optional mathematics. They told me that as a girl I could not study mathematics. There was no friendly culture for learning mathematics indeed in my days" (May 16th, 2011).*

Can I say that girls face different social problems due to negative image of people regarding mathematics? There is boys' preferable culture and lack of sufficient women teachers in mathematics. As a result, boys are encouraged to choose optional mathematics but girls are discouraged. It also seems that teachers also have the perception that mathematics is just for male. So, there is no other way to expect the

positive response from others and society. Binita also shared similar story regarding the same topic;

> *"There is a social belief system that girls cannot study mathematics properly. This influences on choosing mathematics subject for the girls. Still, if I talked with people, they asked about my professional subject. Then people are surprised and make their eyes big and say, "Oh ho, Maths". Such belief system is there in our society and girls could not develop their confidence in studying mathematics till higher level" (May 18th, 2011).*

Mathematics and science have always been stereotyped as strongly 'male' or 'masculine' subject. Can it be due to the reason that most mathematics teachers in secondary school and a large majority of mathematicians were found to be men (Sam, 1999, p. 16)? Binita's opinion shows that our society does not believe that female also can do better at mathematics. If they hear about female mathematics teachers in higher level, they would be surprised. The main cause of it is that every person is guided by social beliefs that mathematics is difficult subject and only male can do better at mathematics. Kamala said;

> *"There is a negative impact of social belief system of mathematics that mathematics is a hard subject. It also follows rote learning and memorizing the formulae which is decreasing the interest of female students' interest towards mathematics. Next thing, girls are not free to learn due to social and cultural barriers. For example, if a son returns home at 8 pm then there is no issue of doubt, but if a daughter does the same then next time she does not get the chance to go out of house for the study too because parents are also bounded by social boundaries" (may 19th, 2011).*

I can say here that due to social belief system that mathematics is not for girls and this type of equation can also be found elsewhere: math = male but math ≠ feminine and female = inferior (Ernest, 2007, p. 7). Girls are psychologically discouraged from their teachers, parents and peers. So, they cannot develop their mentality to study mathematics in higher level. Further, Mahima said;

> *"Girls are socially treated as an individual having low self esteem and confidence. Our society has the concept that they cannot study mathematics in higher level due to its complication. They also believed that girls cannot give sufficient time for mathematics which is required for it. Psychologically girls are treated weakly as mathematics is a male dominated subject. Though they want to study mathematics, they do not choose it due to such social and cultural belief systems" (May 22nd, 2011).*

Stereotypes threaten that mathematics is a hard subject. There is a belief system that girls need to learn more about the household work. Due to household work, they do not get sufficient time to practise mathematics. Thus, they cannot do better at mathematics. In the same way Nabina said:

> *"Girls are bounded by their family boundaries that mathematics is a hard subject and they are forced not to choose mathematics as their major subject. Many of my friends didn't study mathematics after their school because of such belief systems. Girls need self confident in mathematics. They should develop confidence in themselves" (May 25th, 2011).*

From Nabina's point of view, the parents believe that mathematics is a hard subject and girls cannot do well in it. So, many girls do not choose mathematics as their major subject. When I asked Sunita, why she chose Nepali for her major subject, she said,

> *"I did not like our school mathematics teacher and his way of teaching. I used to feel uncomfortable when I saw the teacher. He did not know how to teach and give the concept. Just very few talented students studied optional mathematics in class nine. I studied economics as my optional subject. After SLC, I chose Nepali as my major subject" (May 31st, 2011).*

Among six participants, Sunita had views different from other participants. She did not choose mathematics in higher level due to lack of meaningful and conceptual learning in her elementary level of education. According to her, because of the teacher's attitudes and his rude way of teaching, she did not like to study mathematics in higher level. It shows that she was not interested in learning mathematics because of her teacher's weak performance in teaching.

Chapter Summary

In this chapter, I introduced the socio-cultural dimensions in my research study. They were parental belief systems, early marriage and public image towards mathematics. Then, I interpreted the information that I obtained from the participants.

CHAPTER IV

PEDAGOGICAL DIMENSIONS

Chapter Overview

In this chapter, I address my research question; 'How does school mathematics pedagogy influence girls' higher level mathematics education?' I try to deal with existing school mathematics pedagogy and its influence on girls' higher level mathematics education. I also try to search the relationship between mathematics teachers' professional development and student's meaningful learning interacting with the participants.

Basic Knowledge in Mathematics and its Influence on Girl's Higher Level Mathematics Education

Let me start this section with the popular saying, "*Morning shows the day*". In the same way, if there is good beginning then there is good ending too. The students need to have good understanding and knowledge of mathematics in elementary level to study mathematics in higher level. Ernest (1991) says, "School mathematical knowledge must reflect the nature of mathematics as a social construction tentative, growing by means of human creation and decision making and connected with other realms of knowledge, culture and social life" (p. 207). Unfortunately, to me and my participants, the way of teaching mathematics in the

Second Research Question
It was 'born' during the gestation of addressing the first research question. I conceived the seed of pedagogical themes for few months that influence the female participation in higher education. This was a very difficult period for me to give birth to the second research question. I thought it was very pertinent to interpret the pedagogical dimensions to study the female participation in higher education.

school level is not related to students' context and is not taught practically. Thus, the students are less interested in studying mathematics than other subjects. Teacher's attitude towards students and the way of teaching mathematics is not effective from the perspective of meaningful learning. So, students feel uncomfortable with mathematics than other subjects. Due to the lack of encouragement, joyful environment and teacher's positive attitudes, many students quit studying mathematics after school; many of my female friends did not choose mathematics in their higher studies due to this situation. Teachers' beliefs, practices and attitudes are important for understanding and improving educational processes. Regarding this issue, Anita said;

> *"When I was in class five, I was very poor in mathematics. So, I never passed mathematics and English. In class six, the mathematics teacher was changed. He used to focus on poor students and he was very supportive too. When I was in grade seven, I improved a lot in mathematics. Then I was only a girl to study optional mathematics in class nine. Still I like mathematics a lot" (May 16th, 2011).*

I argue here that teachers' attitude, way of teaching and the interest of students towards mathematics are directly related with each other. Precisely speaking, teacher's attitudes, belief systems and way of teaching influence students learning in mathematics. A teacher is a model of the classroom. His/her each and every activities influence students learning. If all the students get support from the teacher, the number of mathematics students in higher level may increase to some extent. Binita said;

> *"Girls should be encouraged and motivated from the school level and there should be more mathematical activities to make the foundation of girls in*

mathematics stronger. Though I was good at mathematics in my school level but I didn't get proper guidelines in my school days" (May 18th, 2011).

Do you agree with me that achievement without motivation is not sustainable and neither is motivation without enjoyment (Leder, 2006, p. 227)? Though Binita was good at mathematics, she could not get proper guidelines, motivation from the teacher, nor was there encouraging school environment for mathematics learning. According to her, boys are more preferred in classroom while learning mathematics. Teachers also give attention towards boys and few talented students. If we encourage girls and motivate them to build basic knowledge of mathematics during their elementary level of education, they will be interested to study mathematics till higher level. Kamala said,

"*The systems of teaching and learning mathematics need to be improved from the foundation level. Existing system of teaching and learning mathematics is ineffective which is decreasing the interest of students towards mathematics. In my view, primary concept of mathematics should be good. It must be totally practical so that students' including girls' interest towards mathematics can be increased till higher level" (May 19th, 2011).*

From the elementary level, the mathematics needs to be more practical than theoretical. The teaching and learning mathematics need to be context based. We know that "Mathematics learning is always embedded in the social context" (Skovsmose, 2006). Therefore, it cannot be isolated from our social needs and the context. That is why, mathematics needs to be more practical for the students from the very beginning, so that they can learn conceptually and can think positively towards mathematics till higher level. Mahima said,

> *"In our context, basic knowledge of mathematics of our students is very poor. Now I am teaching in +2 level. Students don't know the formula of* $(a+b)^2$ *then how can they do the problem of limit? They don't know simple algebraic division which s/he should know in school level. This example shows that students are poor in the concept of school mathematics. That's why the way of teaching and learning mathematics from the foundation level should be improved so that they could study mathematics in higher level" (May 22nd, 2011).*

Mahima also expressed the same idea concerning the shaky foundation of mathematical knowledge. Here I remember a Nepali proverb "*Jag baliyo bhaye matra ghar baliyo hunchha*" (Its English equivalent is: *Strong foundation ensures a strong house*). There is a lack of foundational knowledge of mathematics not only in the girls but also in boys. Hardly, they studied mathematics till +2 levels, even if they studied they could not pass the exam easily. So, mathematics teaching and learning practices need to contextual and conceptual and they need to be motivated in learning mathematics activities from the primary classes. Nabina said,

> *"From my school days, I was good at mathematics. My teacher was very supportive and also used to encourage me in classroom as I was talented. Then I became more interested in studying mathematics after getting support from my teacher" (May 25th, 2011).*

Can I not say that teacher's supportive behavior influences students' interest towards mathematics? Sunita who is not from mathematics background said,

> *"Though I passed SLC, I never understood mathematical concept in my school days. I used to memorize the mathematical problems just to pass the exam.*

After SLC, it was not compulsory subject to study, so I didn't choose it" (May 31st, 2011).

From her response it seems that due to lack of basic concepts of mathematics, she did not choose mathematics as her major subject. It can be said that there are many other girls who left mathematics in higher study due to lack of fundamental knowledge.

School Mathematics Pedagogy and Girls' Higher Level Mathematics Education

Nepal is a country of having a society of diverse cultures. There are different people having different cultures, rituals, norms and values. So, it is a challenging issue to address different cultures within the mathematics classroom. Every student has their own culture and culture can be understood as knowledge, beliefs and conceptions about particular mathematics topics. However, they can also be understood as pattern of meanings historically constructed and socially conveyed. That is why adequate knowledge of mathematics and pedagogy is essential for teachers to effectively address the needs of a diverse group of students. ERIC (2002) states that pedagogical knowledge means understanding the methods and strategies of teaching (p. 26). Mathematics teachers need to know how differently their students understand mathematical concepts. Therefore, teachers need a deep understanding of mathematics. They need to teach concepts, practices, principles, representations and applications to support instruction. A teachers' conceptual understanding of mathematics content and pedagogical knowledge affect classroom instruction in a direct and positive way. A teacher's beliefs also influence

Complexity Science!
I remember few features of constructivist research and complexity science that move around the theory of emergence. I understand that our perception regarding the research topic may not be final. It is changeable according to the meaning generated in the field and off the field. So, complexity science talks about the fluid structure.

his or her instructional decisions; pedagogical choices will differ among teachers and vary students' achievement result. Dewey (1933) said, "Teaching may be compared to selling commodities. No one can sell unless someone buys" (cited as in Brown, 2007, p. 24). Teachers have to try each strategy and techniques until and unless the students understand mathematical concepts meaningfully.

Given this context, I discussed the school mathematics teaching learning practices and its influence on girl's higher mathematics in this chapter. In a research study by Ernest (1996), 'girls prefer collaborative learning environments, need opportunities to use their language skills, prefer to share and support each other in tackling mathematical problems', 'boys perform better in competitive situations than girls, girls need encouragement to build their confidence and self esteem (Ernest, 1996, p. 225). As a student of mathematics, I have experienced that school mathematics skills are often judged or misjudged by student's performances in math contests; class work-- quickly answered questions. Girls are not as much excited as boys to participate in such competitive environment. This means a girl does not gain confidence to solve mathematical problems in such an environment. Thus, a teacher needs to help her to develop mathematical skills and encourage her from the simple way and not letting her struggle with tough problems. Grouws and Cebulla (1999) state that as teachers seek to improve their teaching effectiveness by changing their instructional practices, they should carefully consider the teaching context, and giving special consideration to the types of students they teach (p. 8). Teaching is not a subject to teach only the matter whatever written in the book. Teachers also need to be well known about their students' nature, culture, level of understanding. Naturally girls are different from boys. They like cooperative and supportive environment of learning than competitive. In the context of Nepal, due to different causes, basic

knowledge of mathematics in students including girls is poor. As a result, girls are very less in number in higher mathematics. Regarding this matter, Anita said;

> *"Initially society has the mentality that girls cannot do mathematics and they cannot compete with the boys. Mathematics teachers also have the cultural social baggage that mathematics is not for girls and this concepts produce discrimination against girls in learning mathematics. From the basic level, students should be focused on getting conceptual learning. For this, initially teacher should be well known about the content and pedagogy. Mathematical concept should be visualized for the students. School level mathematics curriculum is totally practice based but teachers are not doing it" (July 3rd, 2011).*

From her arguments, I understood that existing teaching and learning system of mathematics is guided by lecture method which is making school mathematics an abstract subject. As a result, interest of students in higher mathematics is decreasing. Students' friendly teaching approach and practical mathematics teaching and learning need to be focused in the classroom. In the same way, Binita added her argument like;

> *"In school mathematic classroom, there should be learning by doing environment. There is a Chinese proverb that*
>
> *"I heard, I forget,*
> *I saw, I remember,*
> *I did, I understand".*
>
> *But in our school, teachers just write on the blackboard and students just listen and copy on their exercise book. There is just one way system of teaching. Teachers shout loudly and students listen patiently. There is lack of environment like; mathematics with fun in primary level. Children feel bored*

just to retain the mathematical abstract concept. For example, if a teacher wants to teach Area of a rectangle, he has to let them find out the area of the floor of the classroom by measuring length and breadth instead of shouting like Area = length × breadth. Then they can visualize the theory of area with the real life practices" (July 4th, 2011).

School mathematics can be translated into contextualized knowledge which can be well understood by students. But due to lack of proper strategy for teaching, it is being an abstract subject for students. From the perspective of learning as a series of joyful activities, students are not getting fun while learning mathematics and they just retain it to pass the exams. It is found that students are silent listener in the classroom. Teachers do an example on the chalkboard; and students follow their teacher in solving the remaining algorithmic problems. ERIC (2002) suggests that learner centered instruction provides time for students to reflect and gain a deep understanding of mathematics (p. 21). Not only girls but also whole students can be encouraged to participate in solving mathematical problems using class practical ways, and then they feel fun in learning. In the same context, Kamala said;

"Socially girls are treated with mathematics is not for girls and it's a hard subject. Then they get frightened of mathematics. Up to grade 8, girls lead the good position in the class. But after that they become back in learning. There may be different factors behind it. One main thing may be rapid physical changes and menstruation problem. But boys become active in learning in this stage. In the context of Nepal, mostly geometry in mathematics starts at lower secondary level. Teachers do not give proper concept of geometry in the classroom. I found girls feel hard at geometry. Then they could not cover the rest of the topics in mathematics. Then they feel mathematics hard in class

nine and ten. Later on, their interests decrease in higher mathematics" (July 5th, 2011).

Can I start this section with a Nepali proverb, *"Whether or not the tiger in the jungle eats up, the tiger in the heart really eats up"* (In Nepali: Banko baghle khawos ki nakhawos, manko baghle khanu)? Whenever I listened to Kamala, this Nepali proverb was found applicable in this context. Socially, students are treated with mathematics is not for girls and academically weak students. More efforts have to be rendered on learning mathematics and for which girls do not get time at home. Next important issue, due to their rapid physical growth after grade eight, they feel uneasy themselves. They have to face menstruation problems during this stage. As a result of several un-favoring pedagogical and other situations, they feel hard to learn mathematics and after the SLC they are less likely to choose mathematics in their higher studies. ERIC (2002) suggests that mathematics teachers and school counselors need to facilitate equal access to algebra, geometry and higher-level mathematics courses and see the support required to be successful in these programs is provided for all students (p. 2). In the same context, Mahima said;

> *"Initially girls are made psychologically weak in mathematics from family and the society saying that girls cannot learn mathematics and school teachers also suggest them not to take mathematics as optional subject in class 8 and 9. As a result they lose their confidence to study mathematics in higher level. Next thing students are habitual in rote learning from the elementary level. They are not interested in practical learning. For example; if students would learn* $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ *concept in practical way like cutting a soap then their concept on it would be durable. But due to the lack of practical knowledge, they feel mathematics as a subject of burden. If some students*

choose mathematics in +2 level, they are discouraged to study mathematics in higher level" (July 6th, 2011).

Due to lack of practical knowledge in school mathematics, students become less interested in studying mathematics in higher level. There is likely to exist a positive relation between students' school mathematics performance and choosing mathematics in higher level. Akey (2006, as cited in Brown) found that prior successful level of student engagement in mathematics positively influences academic performance in mathematics in later years (p. 31). On the contrary, the existing practice of teaching and learning mathematics in schools is not much more interesting and successful from the point of view of student's learning. On this issue Nabina said;

"Socially students are treated with mathematics is a hard subject. Especially girls are discouraged that mathematics is not for girls. Due to lack of trained teachers, students are feeling mathematics as much harder than it is. Mathematics teaching learning process totally depends on rote learning and they study just to pass. There is lack of practical knowledge in the students. That's why students feel difficult and do not choose mathematics in higher level" (July 7th, 2011).

The issue of rote learning and subject just to pass is creating big problem in school mathematics. Lack of trained and self motivated teachers, mathematics teaching and learning is becoming as a subject of burden. Just a few talented students are interested in learning mathematics. Can I not say teaching learning strategy needs an improvement to make mathematics an accessible to all students in the classroom? In the same way, Sunita said;

"I was never interested to learn mathematics in my school days. I felt bore while there was time for mathematics to be studied. I could never understand

school mathematics concept properly. I used to retain just to pass exam at that time. That's why I studied Nepali after SLC. Actually, I did not like our mathematics teacher's attitudes and personality at all. I used to feel uncomfortable when I saw my mathematics teacher. He did not know how to teach mathematical concepts. He used to focus only the students who were talented in mathematics. We rest of the class used to feel mathematics as a hard subject" (July 8th, 2011).

Teachers' attitudes impact their daily choices of activities, the amount of effort expended on each and their expectations of student's abilities to perform (ERIC, 2002, p. 28). If students found their teacher unable to address their concerns related to learning, they do not pay their attention towards the subject matter whatever teacher is trying to teach in the classroom. Thus, mathematics teachers need adequate pedagogical content knowledge so as to help students learn mathematics in a better way. If this happens, girl students are likely to benefit as well.

Teachers' Professional Development and Girl's Higher Mathematics Education

Mathematics is intimately involved in our everyday life. From the starting of human existence on this earth, the use of mathematics has been a part of human activities. D' Ambrosio (2001) states that at all times, individuals are comparing, classifying, quantifying, measuring, explaining, generalizing, inferring and in some way, evaluating, using materials and intellectual instruments that belong to their culture (p.13). In the context of Nepal, school mathematics is becoming separated from the individual's everyday life. Students are less likely to get chance to connect their mathematical knowledge they learn at school and their daily life (Luitel, 2009; Poudel, 2010). Mathematics teaching is teacher centered. Teachers do much themselves in the classroom and students are forced to retain rules, formulae and

mathematical patterns without understanding. From such irritating labor in mathematics, students are discouraged to learn this subject. A teacher has a vital role in the classroom and they are expected to have basic set of pedagogical knowledge and skills. "The job of the teachers is not just to teach futile things" (Osho, 2006, p. 14). A teacher has to do his/her best for students' understanding in mathematical concept. Also, a teacher has to play the role of a catalyst to motivate the students in learning from every dimension.

MTED (2009) shows that professional development program is helpful to teachers to understand mathematics better and from multiple perspectives, to meet their students' varying needs, to see where students may get stuck, and to see their students' different perspectives (p. 29). Regarding this, my first participant Anita said;

> *"Teachers should be provided with training, updated programs, encouragement programs and so on. There should be regular training, refreshment program for the teachers. Most of the mathematics teachers are tuition oriented that's why school should establish economic security for the teachers so that economic source can be one catalyst and they could give their maximum time in students' conceptual learning in the school. If teacher could teach school mathematics effectively, there will be no gap remaining between mathematical theory and practice in school level" (July 3rd, 2011).*

According to her, teacher's way of teaching and providing mathematical knowledge to the student is not according to the children's interest. As a result of teacher-centered and didactic pedagogies, interaction in the classroom, project based activities within the students, and hands-on materials are not the key features of Nepali mathematics classroom. A knowledgeable and skillful teacher makes the greatest impact on the learning process of the students; so is needed for promoting

girls in mathematical learning (Davies & Ferugson, 1997; Chong, 2008, p. 1). Can I not say that mathematics teachers need professional development programs so that they could make their classroom joyful and more effective for all students? Can a pedagogically tactful teacher not make a difference in the lives of girl students and other academically weak students? Echoing a similar perspective, Binita said;

> *"Mathematics is a language. For example, there is x + y = 5, then there should be well communication between these 3 elements. If students could understand this communication then they can learn it easily. To make mathematics more practical and interesting, different works can be given like; project works, problem solving relating with daily life so that students could get clear concept by doing and with fun. But lack of well trained teachers, school mathematics is guided by rote learning. Repetition and retention is taking the main method of learning and teaching mathematics. That's why teachers should be provided with trainings. Teachers should be well known about the current situations of mathematics and have to meet global requirements. There should be study and research regarding mathematics pedagogy" (July 4th, 2011).*

Mathematics is a language in which a teacher needs to communicate with the students in a proper and effective way. Why does a teacher need to develop himself or herself to be an effective teacher? Students are not empty vessels to be filled with knowledge; rather they build their own knowledge structures. A mathematics teacher can provide rich opportunities for students to solve contextual problems so that they could relate their theoretical knowledge with their daily life. In the same way, Kamala said;

> *"Basic knowledge of mathematics is not good in students. That's why students cannot understand secondary mathematics too. There is the trend that most of the students fail mathematics in SLC. That's why from the primary level, students should be given practical knowledge of mathematics. Teaching strategy of mathematics should be changed. There should be regular teacher trainings, refreshment programs and proper monitoring and evaluation programs whether the training is being transferred or not to the classroom. Classroom should be managed and the number of students also should be suitable. Curriculum should be context based. There are so many things to improve in our schools to improve teaching learning process" (July 5th, 2011).*

A research by ERIC (2002) shows that students who experience mathematics in a "user- friendly" classroom environment in which prior knowledge is identified and built upon and where instruction is developmentally appropriate, are more successful than students who sit in rows watching, listening or taking notes on mechanical process (p. 84). Do we not need teachers who can promote developmentally appropriate teaching strategies? Perhaps it is the reason that mathematics teaching learning process needs to be learner centered and a teacher should try his/her best to connect the classroom practices with the learners' context or daily life. For this, teacher preparation programs with these sensibilities are likely to ensure girls' increased participation in mathematical education. Next participant Mahima said;

> *"There is a lot of weaknesses in teaching process in school mathematics. For example, if a teacher is teaching perimeter and area, he/she can let the students measure the length of the bench, desk, window, and door and let them find out area and perimeter. But our teachers do not do so. There are very few*

> *schools in valley which give conceptual knowledge in primary level. But most of the schools of Nepal are following the lecture method and rote learning. Students cannot see the use of mathematics in their daily life then they feel that to study mathematics is a matter of burden. That is why they do not study mathematics in further days. From these scenarios, it is clear that mathematics teachers are needed to be provided with training on teaching and the schools have to establish encouragement programs for them" (July 6th, 2011).*

Students are forced to memorize the mathematical concepts without practical knowledge. Though a few teachers are trained but a mass of teachers are not well trained and they do not know how to make mathematics a favorite subject of the students. A research by ERIC (2002) shows that the strongest predictor of students' success is the quality of their teachers' performance in the classroom. Teachers who are highly qualified with both mathematical knowledge and pedagogical skills are more effective teachers (p.84). Therefore, to improve school mathematics teaching learning process and increase the students' interest, mathematics teachers should have rich knowledge of both content and pedagogical skills. S/he has to be provided with professional development programs by school administration and government sectors. Also, they have to be motivated and encouraged time to time from the concerning administrative sectors. In the same topic, Nabina gave her opinion in such a way;

> *"Teachers should be provided with training and training should be given in such a way that teachers could apply it directly in the classroom. But there are trained teachers they are not applying their skills in the classroom. There are different factors behind it. Due to lack of physical facilities in the classroom, proper number of students and teachers' self motivation, teachers are not*

providing practical knowledge in mathematics. There should be social awareness in students and teachers" (July 7th, 2011).

Teachers are often faced with the challenge of instructing students at various levels of academic progress. In such a condition, they need training and other types of professional development programs. Training is a way of helping people to do things they could not do before they were trained. But due to different factors in the classroom, teachers are not able to apply their skills. Thus, school administration has to create such environment so that teachers could use their learnt skills in the classroom. Teachers also need to be self motivated to provide practical knowledge to the students in school mathematics. In the same way, Sunita said;

"Initially teachers should be motivated themselves regarding their teaching profession. They should provide equal attention to the students in the classroom. By using different examples and experiments teachers should provide concept to the students and encourage them. It's the time of technology. Students are well known about the technology but our teaching way is still traditional and boring. Very few private schools are providing concept based education in the school level but a huge mass of schools in Nepal have to improve in their way of teaching. That's why teachers should be provided with different educational training and updated programs time to time from school administration and government sector. Also there should be evaluation and monitoring programs whether the training is implemented properly or not" (July 8th, 2011).

Teaching is an art and it is becoming one of the most challenging professions in our society in which knowledge is expanding day by day. In this situation, mathematics teachers are expected to facilitate learning and make it meaningful to

individual learners rather than just to provide knowledge and skills. Modern technology has provided new possibilities to teaching professions but the use of ICTs in their teaching is being more challenging job for the teachers. Research indicates (Bansal, 2007) that ICT can change the way of teaching and it is useful in supporting more student-centered approaches to instruction and in developing the higher order skills and promoting collaborative activities. That is why, mathematic teachers should be provided with different professional development trainings including use of ICT in the mathematics classroom according to the demand of time.

Chapter Summary

In this chapter, I discussed pedagogical dimensions of mathematics and its influence on girls' higher mathematics education. I interpreted the information that I obtained from the participants regarding pedagogical dimensions and girls higher mathematics education

CHAPTER V

PROGRAMS AND POLICIES FOR GIRLS' HIGHER LEVEL MATHEMATICS EDUCATION IN NEPAL

Chapter Overview

In this chapter, I try to elaborate the ideas on existing policies and practices on girls' education in Nepal. I have discussed how these programs and policies are working in the field of girls' education and how they can be the factors to increase girls' participation in higher education. Further, I talk about answer to my research question. "How can the policies and programs on girls' education play effective role to increase participation of girls in higher level mathematics education?" In responding to this question, I have organized this chapter into the following subsections: scholarships for girls in higher education, hostel facilities and encouragement programs for girls, female teachers and girls' higher level mathematics education.

Scholarships for Girls in Higher Education

From the beginning stage of school, varieties of programs have been implemented for girls' education in Nepal. Different government educational programs have been targeted towards girls' education. Likewise, many NGOs and INGOs individually and jointly with national and international organizations like "Save the Children" worked on literacy, legal advocacy and gender sensitization to uplift the position of girls and women (MOE/UNICEF, 1998, p. 7).

I have come to know that Ministry of Education has implemented various scholarship programs to girls so that they could come forward in the education sector.

Under the Primary School Total Girls Scholarship scheme, each girl from level 1 to 5 and between the age group of 6 to 10 in 40 remote districts is liable to receive scholarship amounting to Rs. 250 for one academic session (Jha, 2007). Similarly, provision is also made to provide such scholarships as Primary School Girls Scholarship, Local School Girls Scholarships, Feeder Hostel Girls Scholarship, Campus Girls Scholarship, Dalit Scholarship to the girls of disadvantaged communities and of remote districts. Besides, provision is also made to provide scholarship to the children of the martyrs. Under the Basic and Primary Education Program, an effort is made to enhance the level of education of the girls under the scheme Education for the Girls, Special Program for the Feeder Hostel, Girls Incentive Scholarship and School Incentive Gift, etc. As a result of some of these activities, the school enrollment rate among the girls has increased and the drop-out rates have been declined.

Policy for Female in Higher Mathematics Education
I am not surprised to know that there are not any such higher education policies to increase the female participation in mathematics education. However, females like me are pursuing higher education overcoming various social and cultural obstacles. When does higher education policy address the disparities of male/female? Is it not the apt time to think about the inclusive policy for increasing the female participation?

Such provisions have given preference to students studying at the primary level. As a result, achievements are particularly visible in the primary education sector, whereas gaps are still large in the secondary and in higher education. "Implementation part of the girls' primary education policy is also not effective. Drastic effort is needed to achieve the MDG 2 and MDG 3 of achieving 'universal primary education and achieving gender equality in primary education by 2015" (Bhadra & Thapa, 2007, p. 31). Colleges and universities have a low number of girls

in comparison to boys. There are very limited programs of scholarship for girls in higher education.

In this regard, Anita said:

"Low economic status of the family is a factor of low participation of girls in higher level mathematics education. If there would be scholarship and hostel facilities for the girls then they could easily get chance to study in city taking major subject of their choice. Government policies and visions are good regarding female education but implementation is poor. There should be effective implementation regarding girls' education. Girls' education programs are more focused on school level especially primary education but higher education doesn't seem preferable" (May 16th, 2011).

Referring to my experience (Chapter One), girls need to go far from their village or hometown because of economic and cultural reasons. But due to residential and expenditure of the study problems parents cannot send their daughters far from house for their higher education. If there would be some facilities for the girls regarding their higher mathematics then they could join college in the city and could study of their choice. Though different policies and programs have been launched in the sector of girls' education, there seems very poor implementation of them. School education is more prioritized but higher education is not focused till present. Due to the lack of encouragement and scholarship programs, the number of students in higher mathematics is likely to have decreased in comparison to other subjects.

Similarly, Binita shared her ideas in such a way:

"I wish the government and other kind of educational institutions could do something for female higher mathematics like; scholarship program, hostel facilities and so on. I entered this college in 2051 B. S. At that time there were

around 15 girls in B. Sc. mathematics but now there is only one girl in B. Sc. mathematics. Students' interest in mathematics is decreasing because of latest new entry subjects also. It is very necessary that students should be increased in mathematics through scholarship and other programs mainly for girls. Though there are many government policies launching regarding girls' education, there is no proper implementation" (May 18th, 2011).

Emergences
While writing this chapter I was in dilemma whether I make separate chapter in order to address the policy issues or I link the issues of policy in each chapter. My plan of writing chapters does not work here and I changed the plan and formed a different chapter addressing the issues of policy in higher education. After lots of changes in my work during the field visit, I realized the emergence feature of the interpretative qualitative research and found myself as an interpretative qualitative researcher.

Bhadra and Thapa (2007) talked about the literacy rate by gender (6 years and above) on their report entitled "Nepal: Country Gender Report" and they show that the level of education has increased, the proportion of girls' net enrolment has decreased and gender gap has increased (p. 31). There may be different reasons behind it but lack of encouragement programs for girls from the government sector may be one reason for it. Government policies and programs should be improved in the field of mathematics education so that number of students can be increased including girls.

Further, Kamala said:

"33% reservation seats for girls are allocated for every sector but there is no effective implementation though population of female is more than 50%. Still I have not taken any benefit from this policy. Education plays the key role in quality of life for every person. Such reservation seats should be implemented properly in female higher education also. There should be scholarship

program for female to increase the enrollment rate in higher education. Due to economic problem, many girls could not continue their study till higher level though they have an interest in study" (May 19th, 2011).

Though females represent more than half the sky of Nepal, they are far behind in higher level mathematics education in comparison to boys. The government has allocated 33% reservation seats for women but due to poor implementation of it, a large number of women are far behind in higher education. As a result, women are rarely found in position of authority and leadership in the country. Women need to be encouraged in higher education from the government sector or any strong source. Due to economic problem also, many girls cannot continue their study after schooling. Mahima said;

"The voice of gender equality and equity in every sector is raised from different medium but reality is vast different. Existing policies are also not properly implemented and women friendly. There are many policies in girls' school education but regarding higher education, there are no any policies and programs launched especially in mathematics. That's why; universities have to manage scholarship to study mathematics for girls. Parents also should be given awareness education regarding their female children education" (May 22nd, 2011).

In the absence of strong legal and monitoring mechanisms in education, many provisions are not effectively implemented (MDG, 2010, p. 38). The voices of gender equality and equity are raised in every sector of development. Policies and programs are more focused on school education of the girls but higher education has not been prioritized as much as it requires. Universities and other educational sectors need to create girls-friendly and supportive environment so that they could continue their

study till higher level. Parents play key role in the family. Thus there can be seen improvement on the enrollment of girls in higher level if there are parent awareness programs regarding girls' higher education. In the same way, Nabina said;

> *"To increase the number of female in higher level mathematics education, there should be scholarship and supportive environment for the female in colleges and universities. There are some policies and programs but not properly implemented" (May 25th, 2011).*

Scholarship and supportive environment for the female in colleges and universities can be a key to increase number of girls in higher education. Sunita said;

> *"Scholarship program focusing on female education can develop their confidence getting support from the universities. The government has lunched different programs to empower female education but has not focused on higher education yet. There are many programs and policies in the school level but they are not implemented properly" (May 31st, 2011).*

Though education of women in particular is seen as providing the key to securing intergenerational transfers of knowledge, and providing the substance of long-term gender equality and social change (UNRISD, 2002, p. 31), due to economic and security problem, many girls cannot continue their study till higher level. Colleges and universities are not focusing on the female higher education. Empowerment programs are limited to school level especially to primary level.

Hostel Facilities and Encouragement Programs for Girls

Nepal is a country having different socio-cultural and geographical variations. There is the same education system all over the country. And, reputed colleges and the universities are located in the city areas. There are a few colleges and universities located in district headquarters. So, girls from villages are less likely to get chances to

study higher education due to their family's economic status, lack of awareness regarding the need for higher education, etc. Parents do not want to send their daughters for higher study due to the problems related to their residence. So, hostel facilities, awareness and encouragement programs need to be run for girls' higher education. In this context, Anita said,

> *"Though there are many +2 schools in villages, there is no access of major mathematics subject for the students. Parents became worried about the girl's residency in city and do not send their daughter to the cities to study the subject of their choice" (July 3rd, 2011).*

Due to the lack of manpower and other facilities, students are compelled to study only available subjects in the +2 level. Thus, girls are not getting chance to study mathematics in their higher secondary level. Also, parents are not ready to send their daughters to the cities due to economic, residential and security problems. Binita said,

> *"Though there are many programs and policies in primary girls' education but there is no proper implementation. In higher education, there are very limited provisions to empower female in education. Hostel facilities in universities and colleges need to be launched. There is a political issue of 33% participation of women in parliament but there is no proper implementation in education and health sectors" (July 4th, 2011).*

Binita argues that the programs and policies are running on girls' primary education but are not implemented effectively. Further, there needs to be programs and policies like hostel facilities, encouragement programs for girls' higher education. Though there is a voice of 33% participation of women in parliament, there is no effective implementation in education and health sectors. Effective implementation of

33% reservation for women in education sector can empower women in higher education. Kamala said,

> *"There should be real implementation of 33% reservation in education sector too. Females are very much sincere on their works but they are not getting chance to do something on decision making position. There should be different programs focusing on girls' higher education" (July 5th, 2011).*

According to Kamala, women are equally capable as men. But, lack of encouragement and lack of opportunities to expose their ability, they have been back in higher education and decision making position as well. As I discussed in chapter three, there are many socio-cultural barriers for girls to continue their higher education. So, government and other types of educational institutions need to focus on girls' higher education. Mahima said,

> *"Due to lack of awareness on parents regarding girls' education, parents do not focus on girl's higher education. For example, I am from Terai and according to our political systems of centralization; students have to come in the mainstream of the country. But due to lack of hostel facilities in colleges and universities and security problems, girls can not dare to stay in a room alone in the city. Parents also seem giving low focus on girls' higher education and they become worried about their daughters' residential problems in the city" (6th, 2011).*

Though the voice of decentralization and localization are raised in every sector at present, existing higher education system is centralized. So, girls are needed to go to the capital city and district headquarters for their higher education. But, due to different reasons like; socio-cultural, economic and others, parents do not send their

daughters to the cities. As a result, there is a low participation of girls in higher level mathematics education. Nabina said,

> *"Firstly positive thinking should be developed in the society that girls are equally able to boys on study. From the first step in colleges and universities, scholarships, hostel facilities and encouragement programs can be launched for girls. In one hand, very limited programs are existing new, and on the other hand, due to lack of proper implementation and lack of monitoring, targeted groups like girls from remote area and having poor economic status are not getting these facilities" (July 7th, 2011).*

According to Nabina, girls are far from the access to higher education due to unfavorable thinking towards their higher education. Society is the mediator of development of the person. So, it is necessary to develop positive thinking regarding girls' education in the society. For this, it is needed to launch different types of encouragement and awareness programs regarding girls' higher education in the society. Sunita said,

> *"Due to economic and security problem, many girls cannot get the chance to study till higher level. If the government could focus on girls' hostel management in college and university level then girls' enrollment could be increased to some extent. Further, there should be awareness programs for the parents and social figures regarding girls' education" (July 8th, 2011).*

Sunita's opinion is also similar to other participants' in this issue. From the responses of the participants, I understood that parents' economic status is a barrier for the girls' higher education in general and mathematics education in particular. So, there is a gap between women and higher education. But hostel facilities in the universities and the colleges may reduce such a gap in higher education. +2 education seems to provide mathematics education all over the country. Though there is a political voice of 33% female reservation seats in every sector, its implementation part needs improvement. Also different encouragement and empowerment programs for girls are to be launched in the society. Then the participation of girls in higher mathematics can be increased.

I Assumed it as a Theory of Emergence

Interviews in the Third Phase
I came to know that the first and second phases of interviews offered me insight into lived realities of the female participants. New agenda gradually appeared so these two phases of interviews seem not to be sufficient so I planned to carry out the third phase of interview expecting to answer my final queries. Again, I had to meet them according to their favorable time. More than this, I did not face any difficulties to meet with the participants and gather the data. In such a way, I took interview thrice with each participant. Then I felt the answers to my research questions were saturated. The second and third visit durations were according to the essence of the information which I had to gather.

Female Teachers and Girls' Higher Level Mathematics Education

In the context of Nepal, there are a few women teachers in educational institutions (school, colleges, and universities). The study reviewed by Bista (2004) shows that the presence of women teachers in schools boosts the confidence of parents, encouraging them to send their daughters to school, especially in rural and conservative areas (p. 10). These female teachers are likely to act as role models for girl students. They can also be supportive factors to create girl-friendly environment in schools. A research study by UNESCO (2006) shows the positive correlation

between the number of women teachers and girls' enrollment in school (p. 6). But due to lack of sufficient qualified women, there are very few female teachers in schools and colleges.

In this topic, I discussed on the female role models and their influence on girls' higher education. In the same way, Anita said,

> *"In school days, society blamed me unnecessarily. There were no any qualified females who could support me in my learning. But now everybody gives me respect. Now I am a role model in my village. I do encourage my junior sisters to develop their confidence in higher study and often say; "I could, why can't you" (May 16th, 2011)?*

Re/ Structure
I read, re/read, think, re/think, plan re/plan design, re/design my field visits, my write up, my analysis, my interpretation. I feel happy when it goes with same plan but most of the time I reframe data collection to analysis. I compared the ideas or views of the participants to organize them together. I gave pseudo names for each participant like, Anita, Binita, Mahima, Kamala, Nabina and Sunita. Further, I tried to themetize the ideas under different headings. According to my research questions, I made nine possible themes from the data.

Anita believes that social system and perception towards girls' education can be changed if there are female teachers in schools and colleges. They are likely to feel secure and encouraged from the female teachers. I found similar opinion and ideas between Anita and Binita. In the same context, Kamala said;

> *"Girls have to face family tension. They have family responsibilities, and are bounded by the family rules and regulations. Nepalese women do not have freedom like women in developed countries. There is no place and no person to share their problems and difficulties regarding their study" (May 19th, 2011).*

Kamala perhaps thinks that due to lack of sharing and caring persons, they face different problems in the society and they do not get proper encouragement to go into the academic field. If there are more female role models in the society, the female participation may be more in higher study because female teachers understand female problems better than male teachers. UNESCO (2006) states that husband and family members feel comfortable to send their girls to schools with women teachers (p. 3). Similarly, Mahima said;

My understanding concerning to the themes was most tough job for me for analysis. So, I went through different research reports to get the ideas on interpretation. Then on the basis of these themes, I began to analyze data in detail with the help of the literature.

> *"Only female can understand female's problem. We can understand the girl's problem. But male teacher cannot understand the problems of female and take it seriously. A student who was writing her thesis said to her male teacher, "Sir, my child doesn't give me freedom to work. So I am unable to do my work on time". But the teacher replied; "Shall I look after your child?" (In Nepali: Timro nanilai ma khelaidiu ta?) She shared this experience with me. Listening to her, I felt bad as I had same bitter experience when I was a student. Therefore, I can understand her problem better. Therefore, it is important to increase the female teachers in colleges and universities. There is a lack of equal right at home as well as in other fields. Because of the family problem also, girls lose their opportunities" (May 22nd, 2011).*

Teachers' attitude is more important in creating a female friendly environment in the academic sector. Girls have many natural responsibilities like; menstruation, pregnancy, motherhood and so on. During these periods, they face different physical and psychological problems. Being a social member, they have to carry out other

social and family responsibilities too. Thus, the girls face problems in their study. There needs to be female teachers in schools, colleges and universities where students feel listened and secure to share their problems they face in their study. To empower the girls in higher education, the male teachers need not make fun of girls' problems and need to encourage them to study mathematics. A research by ERIC (2002) shows girls typically learn better through cooperative rather than traditional competitive instructional strategies. Since, different students learn in different ways, equal treatments for all students do not guarantee equal success (p. 2). In the same context, Nabina said;

Concluding
I generated data, developed themes, analyzed the so called findings and divided the chapters as my supervisor suggested. And lastly I followed the grand suggestion of my supervisor to prepare the final chapter of the dissertation preparing a conclusion chapter including my reflection. In such a way, I came to be able to prepare a first draft of my dissertation work.

> *"I found very few female lecturers or professors participating when there is mathematical training and programs. There should be lots of female mathematic teachers and mathematician as role model in our society. Due to lack of female role models, girls are discouraged to study mathematics in higher level" (May 25th, 2011).*

Nabina perhaps considers that society is not interested in investing money on girls' education as they have to be someone's. Parents are unaware of the benefits of girls' education. If the teacher is female, the society can realize the importance of girls' education. There are very few women teachers in schools and colleges and they are rarely found in positions of authority and leadership. Because of the low status or position in schools and colleges, their voices are excluded or not taken seriously. There needs to be sufficient number of women teachers in the academic field. Hence,

policies and programs need to focus on recruitment of female teachers in the universities and colleges.

Chapter Summary

This chapter tried to answer my research question ‘how can programs and policies on girls’ education play effective role to increase participation of girls in higher level mathematics education’. I interpreted the data which I got from the participants interacting with literatures which I found from different sources.

CHAPTER VI

REFLECTION, FINDINGS, DISCUSSION AND CONCLUSION

Chapter Overview

This chapter concludes my study which I had drawn from Chapter I to Chapter V. My reflection on research problem has a great importance from the view of my learning as a researcher. This chapter also provides some suggestions and guidelines to the readers, educational leaders, curriculum designers, and policy and program makers to empower women in higher level mathematics.

My Reflection and Conclusion

When I selected my topic for my research study, I had no idea about the research and many questions arose in my mind. My dissertation supervisor suggested me to start writing in narrative depicting my experiences of the past days. I remembered the days of choosing optional mathematics in class nine and the first day of mathematics classroom in class eleven. I had seen the low participation of female students in mathematics up to the master's level. Observing such scenario of my life, many questions were raised in my mind and I started thinking a lot about the reasons behind it. Those questions were my research questions at that time. To get the answers to my questions I had gone through some dissertations, reports, journals and articles

False Consciousness
The day when I submitted the first draft of the dissertation work, I thought that I completed all the works which I had to do as a researcher within a set of certain criteria. That was the work according to my understanding but the works to do as being an academic researcher was just started. Standing myself as an academic person and to meet the requirements of the academic writing, many works were remaining.

from which I made some ideas which were helpful for my study. Further, I took some ideas from seniors who had already completed their research works and my teachers.

Initially, I tried to look into existing perceptions on women's higher level mathematics. I visited five colleges of Kathmandu valley to find out the existing practice of women's enrollment in higher level mathematics. I also browsed websites of different journals, books, articles, news flash and reports to find out the existing practices on girls' higher level mathematics. Reading different related materials, I realized that there is a need to study the participation of girls in higher mathematics. So, I prepared some interview guidelines and went to the field. At that time, my mind was guided by a question how socio-cultural dimensions influence girls' higher education. Keeping the relationship between socio-cultural dimensions and girls' higher mathematics in my mind, I conducted interviews with my participants on the basis of the guidelines. From the interviews with the participants, more themes were generated than my expectation. They talked about pedagogical dimensions and policies and programs related to girls' higher education. From this interaction, I realized to restructure my research questions. So, I modified my research questions again. But it was not final one, so I modified them again due to my participants' views on this research study.

Standard Writing Format
During the journey of my master's degree in Kathmandu University, I found that it is trying to develop writing skills in learners according to the international level. So, to maintain the writing standard of APA in my research work was another challenge for me. My research work was not generated just from a single idea.

From the research work, I realized that whole research is guided by research questions. Though I had addressed some research questions in the initial research framework, they could not be final one. I restructured and modified those research

questions several times according to the purpose of my study. Then I got the following research questions for my study.

1. Why is female participation low in higher level mathematics education?

   I developed the following sub questions so as to respond to this major question.

   a) How do socio-cultural dimensions influence the participation of girls in higher level mathematics education?
   b) How does school level mathematics pedagogy influence the participation of girls in higher mathematics?
   c) How can the programs and policies on girls' education play an effective role to increase the participation of girls in higher mathematics education?

From this research study, I came to know that methodology is the backbone of a research study and research questions are the guidelines of the study. So, I would like to conclude my study from the answers to those research questions since my whole study is based on the answers to my research questions.

Confusion to Consolidation
Being a learner of qualitative research, I was confused many times; during the field work, during the write up during the analysis and interpretation of the data. I felt difficulties in giving the right shape to the research. Till that moment, I internalized that whole research work was the answers to my research questions. So, I tried to write the findings of my research work by answering the research questions briefly.

Q. 1 Why is female participation low in higher mathematics education?

The first research question forced me to search the existing practices on women's higher level mathematics education. Finding the answer to the first research question was not a simple task for me.

This study covers broad areas of women education and includes all possible reasons of low participation of women in higher level mathematics education. I could not do as I had wished as there were many obstacles. I tried to answer this question only from the point of view of socio-cultural dimension, pedagogical dimension and effectiveness of policies and programs.

Studying the literature related to my research study and interaction with the participants, I found different factors which influenced girls' higher level mathematics education. The most influencing factors I found were Nepalese socio-cultural dimensions, which favor boys more than girls in every sector of the development. Next was existing school mathematics pedagogy and weak achievement of girls in school mathematics which could not provide the strong background for mathematics study in their higher level. And next aspect was programs and policies on girls' education. Because of their poor implementation, monitoring and evaluation system, they are not fruitful to empower the girls till higher education. There are very few policies and programs to empower the girls in higher level. Due to these reasons, girls do not participate equally as boys in higher level mathematics education. In other words, there is very low participation of girls in higher mathematics. The answer to my research question one is included in research questions (a), (b) and (c). In other words, the answer to the research question one is scattered all over the chapter III, IV and V in more descriptive form. So let's try to get the answers to those sub-questions.

Q. (a) How do socio-cultural dimensions influence the participation of girls in higher level mathematics education?

From the existing practices of the women's higher mathematics, disparity between men and women is found in the participation rate. There were different factors creating such disparity in the participation of higher mathematics. Socio-cultural

dimension is one of them. Every society has its own norms, values and rituals. My research is based on Nepalese culture so I tried to view it from the Nepalese socio-cultural perspective. From the literature review and the data I collected from the participants, I found that socio-cultural dimensions like, parental belief system, early marriage, public image of mathematics and the stereotyped threats like mathematics is hard and only for man and lack of female role models was causing the low participation of girls in higher level mathematics education.

The patriarchal social structure and more preference given to boys are creating inequity and inequality in the case of girls' higher education. Sons are treated as superior and daughters as inferior though they are born from the same woman. Exploitation and oppression of women on grounds of tradition, superstition, and conservative beliefs are contributing to unequal treatment between sons and daughters. The first priority goes to sons by birth and parents think that sons are the security of their old age and they are the person to handle their lineage. Also parents think that investing the property on their daughters' education is just wastage. It seems that Nepalese parents are largely unaware of their daughter's education. Daughters also cannot decide themselves regarding their education either in higher or in school level. As the parents are the key persons of the family, each and every decision of them depends upon their parents. Thus, there are very few females in higher education, especially in mathematics education.

The next influencing factor on girls' higher education is early marriage. Though marriage is taken as an essential aspect of life in Nepalese society, but early marriage itself is a barrier for the women's higher education. After marriage, girls have to play the role of a wife, daughter-in-law and care her family members because in Nepalese society, daughter-in-law is taken as a care-taken of the family. Such

social system makes the girls play dual role in her life being a caring person and a student and professional. But the social belief system does not favor daughters' or daughter -in-laws' education. So, women are discouraged to go to colleges or universities and cannot continue their study though they are enrolled in the academia. Due to biological nature of the women, pregnancy and the responsibilities of the motherhood also come together with the marriage. Because of such responsibilities they do not get sufficient time for their study, especially mathematics. Thus, I found early marriage as one of the influencing factors on girl's low participation in higher mathematics.

Looking at different social practices, Nepalese society is male dominated society and there is the tradition that mathematics is just for males. There is an image in the society that mathematics is hard and time consuming subject which a lady cannot study. From the interaction with my participants, I found that they were also discouraged to study mathematics from their secondary level. But due to their strong confidence and self esteem, they were able to pass mathematics till higher level. So, from the society the girls are discouraged to study mathematics considering it as a hard subject and it is not for them. Then the Nepalese saying *"Whether the tiger of the jungle eats or not, the tiger in the heart eats up"* is true. Due to lack of supportive environment of the society and the family members, girls lose their confidence to study mathematics in their higher study. If there were a few female role models in the society, other girls could be motivated to study higher mathematics. Thus, there is low participation of girls in higher mathematics.

R. Q. (b) How does school level mathematics pedagogy influence on the participation of girls in higher level mathematics?

The study shows that the existing school mathematics pedagogy is mostly guided by traditional way and rote learning though school mathematics is almost based on practical activities. Primary mathematics is based on practical activities. Lower secondary and secondary students also can be taught by taking examples from their real life or basing on real life activities related to the topic context. But due to lack of well trained teachers and proper classroom arrangement, school mathematics is being a boring subject for almost all the students. They copy the exercise and retain the formulas and the mathematical patterns just to pass the exam but do not try to contextualize them to their real life. Such practices are creating a gap between mathematical theory and practice. The students are unable to visualize the mathematical concept in their real life and they do not want to study mathematics in their higher study.

Teachers' professional skills and their way of presenting every mathematical concept in the classroom are also important factors. Though a few teachers are well trained, due to lack of sufficient teaching materials, effective monitoring and evaluation techniques and the teaching efficiency of the teachers, proper number of students and size of classroom, they are unable to demonstrate their skills in the classroom. Due to these reasons, school mathematics is remaining a hard subject not only for the girls but also for all the students. Also school mathematics and higher mathematics are interrelated to each other but due to the lack of strong foundation of the mathematical knowledge, girls do not want to study mathematics in their higher level. Therefore, there is low participation of girls in higher education.

R. Q. (c) How can the programs and policies on girls' education play an effective role to increase participation of girls in higher mathematics education?

Reading different related literatures on existing programs and policies regarding girls' education in the context of Nepal, I found almost all the programs focusing on girls' school education. Girls' primary education has been given more priority from the government sector and different types of I/NGOs. Though many programs have been launched from different sectors in girls' education, due to poor implementation and evaluation, they do not seem to be effective.

From the participants' point of view, there is no any provision of scholarship for girls in higher mathematics education. Another factor that influences their study is economic status of the family. In the society, girls' education is given less preference in comparison to boys. Also due to lack of economic status of their family, they do not get chance to study till higher level. Nepal has more villages than cities. And Maximum number of population also lives in the villages but due to lack of colleges and universities near to their house, girls are not getting chance to study till higher level and the subject of their choice. Due to residential and security problems, parents do not want to send their daughters and daughter in laws to study higher education in the urban area. There is also an old myth that mathematics is just for male. Similarly, due to the lack of female mathematics teachers in higher level and "they feel uncomfortable with the male teachers who teach their daughters in the classroom" (UNESCO, 2006, p. 3). So they do not want to send their daughters to study higher mathematics. Thus, there is low participation of girls in higher level mathematics education. In this way, my research study is concentrated on searching the answers to the questions related to the female participation in higher mathematics education.

Discussions on Critical Issues

According to the purpose of my study, I met the participants and I found the deep understanding of them regarding the essence of girls' higher education, its impact on their daily life and social well being. As the area of my study was girls' higher mathematics, I visited six participants. I got their understanding and perceptions about mathematics and what types of problems they faced on their journey of mathematics till higher mathematics study from five participants. Likewise, I chose one participant beyond mathematics background to know why she could not continue her higher study majoring in mathematics. I gathered related information for this study from previous research and literatures as well.

Self Realization!
Now I am feeling that I am almost in the turning point of my research work. I do not claim that I get the knowledge of being a good researcher but I can say this works will be the key for doing other types of research work in my future. From this research, I came to know that the social structures of Nepal favor male over female on mathematics education.

In every society, there are certain values, norms and belief system. In some societies, something may have great values whereas in other society, the value may not be given for the same thing. Each member of a society develops positive or negative thoughts towards any concepts according to the values given by their society. In learning mathematics also, different people have different values and norms. The belief about the mathematics and girls' performance seem negative in almost all the societies. It created a kind of negative attitude among girls towards learning mathematics. Belbase (2006) states, "Creating positive learning cultures within our settings will best support children develop understanding" (p. 181).

From the beginning of their growing-up, girls are treated according to the different socio-cultural norms which are different from those which are set for boys.

For example; girls need to learn the way to work household activities and the way to handle the family members and boys need not to do household works. He has to give his maximum time to his study. The study shows that parents think that daughters are the guest for a few days and they are the property of others. They also think that daughters' study is valueless for them. They are largely unaware of the benefits of girls' education. It is often difficult for people to see a connection between women's education and economic development, better health, child development, family welfare and overall social progress (Bista, 2004, p. 7). That is why parents do not want to send their daughters to schools too in rural areas and do not want to continue their daughters' education till colleges and universities. Priorities are given to daughters' marriage than their study. Even if girls get chances to study till higher level, due to social impact that mathematics is a hard subject and is male centric, parents do not encourage their daughters to study mathematics in higher level. That is why, there is very low female participation in higher level mathematics education.

Alien Mathematics
How mathematics became alien to girls? The question cannot simply be answered because it has been associated with various socio-cultural dimensions like; parental belief system, early marriage, public image towards mathematics. Thus, girls are discouraged to study mathematics in their higher study. I found these factors are the basic factors that prevent girls from selecting mathematics in higher study. Similarly, lack of proper basic knowledge, school mathematic pedagogy and teachers' professional skills seem to be other barrier for girls for not choosing mathematics in their higher classes.

The study indicates that early marriage is one of the barriers of girls' higher study. Due to parents and social belief systems that girls are the property of others and marriage is more preferable than their study girls are lagging behind. After getting marriage, they have to fulfill different responsibilities like as a wife, as a daughter-in-law and so on. Daughter in law is taken as a person to do household activities and to

care family members in almost all the Nepali societies. That is why, it is difficult for her to manage time for her study and career. Also, family members do not want to send their daughter in laws outside the home. After marriage, pregnancy and motherhood also become other barriers to continue their study. As mathematics is considered to be a time consuming subject, females do not get sufficient time to practice and conceptualize mathematics at home. Therefore, they do not show their interest in studying mathematics in higher level. If some women have chosen mathematics after their schooling, due to lack of time and appropriate environment in the family, they could not continue till university level. So, there is low participation of girls in higher level mathematics education.

The study shows that negative public image towards mathematics is another factor to reduce female participation in higher mathematics. There is also the social perception that mathematics is difficult, abstract and just for man and clever ones. Due to such stereotyped threat and its psychological effect, girls are discouraged to study mathematics in higher level. Next thing, poor teaching learning strategy in school mathematics and teacher's negative attitudes, girls perceive mathematics as a hard and abstract subject. They think that mathematics is not really for girls and it has time consuming features so mathematics is not appropriate for them. That is why girls' participation in higher level mathematics is very negligible.

I came to realize through this study that due to lack of proper basic knowledge of mathematics in their elementary or school level, girls are losing their confidence to study mathematics in higher level. There is lack of encouragement, joyful environment and teacher's positive attitudes in school mathematics. Disempowering socio-cultural practices like; mathematics is only for boys, a hard subject, girls are discouraged to study mathematics in their higher study. Due to lack of practical

knowledge of school mathematics, students do not find the connection between their real life and the mathematical knowledge they have learnt. So, they do not see the importance of mathematics in their future and do not study mathematics in higher level.

The study indicates that mathematics teaching and learning ways from the schooling is not good. Existing school mathematics teaching learning practices seem failing to address social and cultural needs of the students. Students just retain the mathematical concept and formulae and the ways of solving the problems just to pass the exams. There is lack of the use of effective teaching learning activities in mathematics classroom. School mathematics is totally based on rote learning and lecture methods though school mathematics curriculum is based on practical activities in commensurate with daily life. Teaching learning process fails to connect the link between mathematical theoretical knowledge and the students' real life or context. A few schools of the valley are good in the sense of providing contextual knowledge of mathematics to the students but huge mass of schools are running from the traditional ways of teaching learning mathematics. From such practices, girls are not interested in studying mathematics in higher level. That is why, teachers need to be able to address the students' daily life problems regarding mathematics. For this, mathematics teachers need to have pedagogical and content knowledge. Teachers need to have deep understanding of mathematical concepts, principles, practices they teach in the classroom. Then, female students in the school level can make deep understanding in mathematical knowledge and their interest in mathematics can be increased.

The study shows that teacher's professional skills influence the girls' higher level mathematics education. In the context of Nepal, school mathematics teachers are found employing traditional ways of teaching and are very poor in the modern

technology and skills related to mathematics teaching. There is lack of well trained and self motivated teachers in the school level. Due to lack of effective teaching learning approaches, context based learning, classroom activities, community project based activities, use of ICT; mathematics is being a subject of irritation in the school level. Classroom management is not good for the classroom activities whatever teachers want to conduct mathematical activities in the classroom. Such situations are leading to poor achievement in mathematics in school level. Therefore, students are not interested in studying mathematics as their major subject in higher study. As a result, there is low participation of girls in higher level mathematics education.

Furthermore, the study indicates that there are very limited programs and policies to empower girls in higher education. The programs and policies are mainly focused on girls' primary education. Due to economic and security problems, girls are not getting chance to study till higher level. If girls pass their schooling from the rural areas, due to residential and security problems, parents do not want to send their daughters to the college of the city where they can study mathematics according to their choice. In the context of Nepal, patriarchy is unfavorable for the girls' education. Though there are many political issues of gender equity and equality in every sector, their implementation part is very poor. Rights and facilities are limited to high castes and urban areas' girls but a large number of populations of Nepal are in the village. This factor is also causing the low participation of girls in higher level mathematics education.

I came to know if there is a female teacher in a school and in a college, girls feel free to express their problems and they also assume her as their role model. Parents feel comfortable to communicate with female teachers regarding their daughters' education. They also feel comfortable to send their daughters, daughter-in-

laws to the colleges and universities where there are female teachers. From this point of view, it can be said that female teachers can play as role models in the society so that parents could send their female members for the higher education without any doubt. Girls also can build up their confidence to study mathematics in higher level from female role models. Female teachers can also understand girls' problems in better ways than male teachers and can provide proper guidelines. She can understand the voices of her female students as being female herself and she may be able to advocate for better policies, programs and facilities about the girls in colleges and universities. That is why, female role models can support and encourage girls to successfully complete their studies and maybe even continue studying to become teachers themselves (UNESCO, 2006, p. 2). But due to lack of sufficient female teachers in colleges and universalities, girls' participation in higher level mathematics is very low.

Need of Prompt Policies
It may not necessarily be a recommendation for formulating policy but I think higher education policy for promoting female participation needs to be revisited and reformed. I believe that effective and encouraging programs and policies increase the participation of girls in higher mathematics education. There are many other factors like; political, economical, agricultural factors are not included in this research work due to different factors. So, further researches need to be conducted including those topics.

From this research study, I understood that socio-cultural and academic factors need to improve to increase the participation of girls in higher level mathematics education. It seems that parental belief systems have great impact on girls' higher education as they are the key persons of the family. Early marriage is being a challenging issue in girls' higher mathematics education. Due to time factors and other types of household responsibilities, females are not getting chance to study higher level mathematics after marriage. Due to different social and cultural

boundaries, women are not free to study higher education. They have to move according to their husband and father in law's decision after marriage. Also, due to negative public image of mathematics, girls are not getting support and encouragement to study mathematics in higher level though they have interest and capacity to study mathematics.

As a result of 'shaky foundation' of school mathematics, many students cannot build up confidence to study mathematics in the higher level. Due to lack of cooperative and friendly environment in learning mathematics, girls cannot achieve the mathematical knowledge as much as boys. Question answering and solving the problems given in the class work are very competitive. Girls love to learn in cooperative and friendly environment but existing mathematics teaching learning approach is more focus on competitive and based on hard and fast rules which is opposite to the nature of girls. Biologically, girls face problems of menstruation from the adolescence and have the responsibility of pregnancy and motherhood after getting married. So, it seems that women need more supporting and encouraging environment for the higher mathematics which is lacking the existing practice.

A teacher's knowledge has a great impact on students' learning in the classroom. But from the study of existing situation of mathematics classroom teaching in the school level, this study shows that there is lack of qualified and well trained teachers. A good mathematics teacher needs to have adequate pedagogical and content knowledge. Only then s/he can address the social and cultural needs of the students related to mathematics. Teachers need to have skills to visualize, feel and touch mathematics in the context of students so that students' interest could increase towards mathematics. The study also shows that female teachers can be the role model for girls to study higher mathematics and they can be good counselors for the

girls and can solve the problems of girls in better ways than male teachers. It can be understood that female teachers can be the pillars of security and medium of the advocacy for the voice of girls in the colleges and universities.

The voices of gender equality and equity are raised in every sector including education but its implementation is not effective. The study shows that due to different problems like; scholarship, hostel facilities, many girls are not in the mainstream of higher mathematics. The programs and policies need to focus on girls' higher education including mathematics.

Educational Implications of the Study

From the experience of this research study, I inferred that socio-cultural dimension has a huge influence on females' higher education. The girls did not get chance to join in colleges and universities due to those socio-cultural factors like, parental belief system, early marriage and so on. Thus, different kinds of awareness programs regarding girls' higher education need to be launched in the society. Parents and girls themselves need to be aware of the importance of education. Social representatives also need to give their concern on girls' higher education for social development and well being.

Does it contribute?
I hope this work will add a brick in the area of women higher education and if a person wants to go through this report may take benefit to some extent. As being an academic researcher, it is my first work so many things are in the way of my upcoming learning days because I believe in the dictum "Learning is a lifelong process".

Though the primary mathematics curriculum is entirely based on practical activities, teaching learning style is still based on rote learning. Due to lack of teachers' mathematics pedagogical knowledge, school mathematics is being a hard subject for the students. So, programs on school mathematics teachers' professional development need to be focused. It is clear that girls' participation cannot be

increased in higher level mathematics education unless school mathematics pedagogy changes. Professional development programs, refreshment training and motivational programs for teachers should be provided.

Colleges and universities need to focus on girls' hostel facilities, scholarship provision and other types of facilities to increase the number of girls in higher level mathematics. The government needs to make the provisions for free and compulsory education for all children up to higher level. Establishment of hostels and provision of other incentives are needed for girls' higher education. There is also a need of female teachers' recruitment in colleges and universities. If female teachers are recruited, they can play as role models for girls. In this respect, gender sensitization program can also be launched in the society.

I conducted this research in the Kathmandu valley. I did not include socio-economic and political perspectives on girls' higher education. So, further research needs to be conducted on the basis of socio-economic and political views on girl's higher education. Due to many factors, I could not go outside the valley. Further researches are needed to be conducted out of the valley too.

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