BECOMING A 'GOOD' MATHEMATICS TEACHER: AN EPIC JOURNEY THROUGH DIFFERENT MATHEMATICAL TERRAINS

Toyanath Sharma

A Dissertation

Submitted to

School of Education

In partial fulfillment of the requirements for the degree of

Master of Education in Mathematics

Kathmandu University

Dhulikhel, Nepal

May, 2012

COPYRIGHT

DECLARATION

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

_____

Toyanath Sharma

DEDICATION

To my mother Ima Bhattarai and Late father Krishna Prasad Bhattarai

AN ABSTRACT OF THE DISSERTATION OF

Toyanath Sharma for the degree of master in mathematics education presented on May 02, 2012. Title: "*Becoming a 'Good' Mathematics Teacher: An Epic Journey Through Different Mathematical Terrains*".

Abstract approved _____

Associate. Prof. Bal Chandra Luitel, PhD

Dissertation supervisor

Kathmandu University School of Education

This dissertation portrays my experience as mathematical learner and as a novice teacher from the viewpoint of autoethnography as the genre of writing and research that connects the personal to the cultural placing the self within a social context (Reed-Danahav, 1997). I have presented comprehensively my learning practice of mathematics at school, colleges and University, teaching practices of mathematics at school. To portray my research study, I have chosen an autoethnography as a method and methodology of research and critical research as a key research paradigm. Autoethnography helped me to produce the research text of my cultural and professional contexts of learning and teaching mathematics. The critical paradigm helped me to identify my research problem, to critically reflect upon my teaching-learning experiences and to transform my teaching/learning from traditional conception to new conception. Meanwhile, I have also used interpretivism and postmodernism as supportive referents

and paradigms for the critical paradigm of my research. In regard to theoretical referents, I have considered critical theory, constructivism and different learning theories as my guides. Reflective practice is my focal point in this research. I hope to have focused on my journey from traditional mathematics learner to critical teacher researcher. In this process, I have continuously focused on relationships, contradictions, and the transformative possibility of my thinking and actions with reference to critical reflexivity as my quality criteria.

This epic journey has also seen various moments of my mathematical learning which seemed to have influenced by various factors and facets that correspond to the situation where some children of Nepalese school are still facing similar problems for learning mathematics meaningfully. So as an autoethnographic researcher, I hope that this dissertation might provide the way out for those students whose mathematical learning appears to have been influenced by various factors that I have faced during different learning stages in my life. I also used this autoethnographic portrayal 'to explore the problem of the culturally decontextualised nature of Nepali mathematics education' (Luitel, 2007, p. 219) and to transform my own pedagogical practice as a practitioner, learner and teacher being critically aware of my lived reality and also create an avenue for professional educators, teachers and practitioners to rethink their own pedagogical practices (Smith, 2001, as cited in Luitel, 2007).

In the process of narrating and performing my stories, I have attempted to set my journey of learning and teaching mathematics to present my extensive experience as a student situated in traditional teacher-centered classroom from early school days, to college and university level of study attempting to make a significant departure to

managing a ‘student-centered’ during my teaching career at primary level mathematics classroom teaching. I hope to have used some ingredients of transformative learning and teaching. As a result, I felt like I could be a teacher researcher through my reflective practice of teaching and learning mathematics. Furthermore, I have duly realized that reflective practice could be instrumental in bringing transformation in meaningful learning of mathematics.

Degree Candidate

_____ May 02, 2012

Toyanath Sharma

ACKNOWLEDGEMENTS

I would like to express my gratitude and heartfelt thanks to my supervisor, Associate Prof. Dr. Bal Chandra Luitel for encouraging me to carry out the study by providing guidance, constructivist suggestions, instructions and cooperation throughout this study. I am indebted for the necessary materials that he made available to complete this research.

I would like to express my sincere thanks to Prof.TankaNathSharm, Ph D, Dean, of the School of Education, Kathmandu University for his facilitation. This study would not have been possible without his support.

My sincere thanks also goes to Assistant Professor Tika RamPokhrel, whose critical suggestion and feedback helped me a lot in this dissertation preparation. My heartfelt thanks go to Lecturer Sahadeb Upretee, who encouraged and supported me throughout the research project.

I would like to express my sincere thanks to Madhukar K.C. who always managed his invaluable time for correcting and editing English language and Asst. Pro. Tika Ram Pokhrel for preparing the dissertation according to the standard style of writing (APA).

I would like to express my sincere thanks for my brothers, Hari Sharma and Khimanada Sharma for their regular encouragement and support. I would like to express my heartfelt gratitude to my sister and brother-in-law, Durga sharma and Bheshraj Sharma respectively to create an environment for my M. Ed study. I would like to express my thanks to cousin brother, Manoj Upadhaya for his support.

Thanks are due to my loving nephew and niece Prabhat and Pratistha respectively for their continuous love and respect.

I am thankful to the Principal of the school, Ms. Sheetal Rana for providing me time for this research project. I am thankful to my friends Anil Bhusal, Abyekta Khanal, Prashant Rajak, Ramesh Neupane, Man Kumari Thapa, Mira Gurung, Kiran Kuwar, Anjan Bhandari, Narayan Banjade, Pramod Nepal, Suraj Gaire, Krishna Kharel and Shiva Devkota, Sunil Dhakal, Mahesh Bhattarai for their moral support.

I am thankful to Mr. Raju Maharjan and Mr. Dil Bahadur Shrestha, administrative staffs of Kathmandu University, for their supports in my research work, and librarians for providing me required books and research materials available at KU library.

I am highly obliged to all the members of research committee for their inspiration, guidance, suggestions and constructive comments.

Master's degree in Mathematics Education dissertation of Toyanath Sharma presented on May 02, 2012.

APPROVED:

_____ May 02, 2012

Associate Prof. Bal Chandra Luitel, PhD
Dissertation supervisor

_____ May 02, 2012

Associate Prof. Peter Charles Taylor, PhD
Curtin University of Technology, Australia
External Examiner

_____ May 02, 2012

Mr. Sahadev Upretee
Member, Research committee

_____ May 02, 2012

Prof. Tanka Nath Sharma, PhD
Dean, School of Education

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

_____ May 02, 2012

Toyanath Sharma, Degree Candidate

ACRONYMS

M. Ed.	Master in Education
B. Ed.	Bachelor in Education
I.A.	Intermediate of Arts
SLC	School Leaving Certificate
HSEB	Higher Secondary Educational Board
TU	Tribhuvan University
KU	Kathmandu University
UNESCO	United Nation Educational, Science and Cultural Organization
PhD	Doctor of Philosophy
M. Phil.	Master of Philosophy
B. C.	Before Christ
STTP	Secondary Teacher Training Program
LCM	Lowest Common Multiple
KUSOED	Kathmandu University, School of Education
APA	American Psychological Association
VDC	Village development committee

TABLE OF CONTENTS

CHAPTER ZERO

SETTING MY JOURNEY OF RESEARCH

Chapter Overview

This research portrays my epic journey of research setting. It presents my brief journey to search for some of my mathematical beliefs and conditions which might have influenced me to develop my conceptual/contextual understanding of mathematical knowledge. It comprises wide array of research issues under various themes below:

- Telling a brief story
- My research goal
- Significance of the research
- Chapter outlines

Telling My Short Story

When I started to learn mathematics, there were many constraints which might have influenced me to learn mathematics meaningfully. As a mathematics learner and teacher, I sometimes felt very easy to understand the mathematical terms and sometimes felt very difficult to understand the mathematical terms and learning process. In my mathematics learning process, I solved and understood different algorithmic problems of mathematics. From my experience as a learner, I found several facilitating and hindering factors which are directly associated with my learning process. My social system, cultural values, teacher's belief system, parents'

belief system and expectations, ethnicity, economic status of my family and my own evolving belief systems are the major elements of my mathematical learning process.

As a mathematics student in my school days, I never felt that mathematics was our own subject. My assumptions about mathematics as a mark securing subject (although I never got excellent marks in my mathematics) always pushed me to try different strategies of learning. Sometimes I thought rote-memorization was the best way of learning and at times I thought conceptual knowing was the best way of learning. I rarely found that mathematics is presented as a social subject. When I followed conceptual and contextualised knowing by relating mathematical ideas with my cultural world, I never got excellent marks on mathematics. But when I followed rote memorization, I secured excellent grades. These all the experiences pushed me to think about my learning strategies. I faced many problems in my student life--sometimes economic condition raised trouble on my study. At some stage of my life, I felt that there was nothing more important than money, the belief of which contributed to the development of different image of mathematics. Now, I want to 'actively' remember my critical events as a basis for examining my cherished beliefs on mathematics learning process (Luitel, 2009).

It was a 'real' story of my mathematics class in Grade Eight. Once, my mathematics teacher came to teach us Algebra. He started his teaching from the topic of Indices and he solved some algorithmic problems. Suddenly, I asked him, 'How did you write this term, where does this come from?' Then he said to me, 'It comes from my pocket and it comes from window'. I was surprised and started to think about mathematics differently. Unsurprisingly, that event discouraged me to learn mathematics.

Most of my friends took mathematics as a subject imposed upon them. As my learning experience suggests, mathematics was taken as a formalised (e. g: mathematics with theories and formulas), structure based (e. g: prescriptive solution of algorithmic problem), logical (for example: dualistic logic) and intuition-oriented (e,g: mathematical objects already exist, we do not create them, we discover what is already there through our 'pure' mind divorced from the body) subject. Perhaps, these all belief systems forced me to think about my mathematical learning process. I could not see my teachers trying to develop mathematics in and for our context. So I felt mathematics very hard (Taylor, 1996).

Although I have developed a heightened sensibility that mathematics is not a rigid subject and there are not any fix images of mathematics, the need of this research lies in documenting the process of coming to this realisation. In my research, I hope to have explored some themes like mathematics, culture and society, the structure of mathematics and its influence on the learning process, mathematics learning as a cognitive process, mathematics learning as social process, affective conditions of the mathematics learning process and new technologies and mathematics learning. Moreover, I hope to have felt the need to apply reflection for improved action; reflection which purpose is to affect current practices for empowering learning strategies (Jaworaski, 1998). Reflective approach could be very much useful for improving meaningful learning. Teachers need to reflect themselves for observing oneself as a teacher, thinking about the observed experience to gain understanding and meaning of what is happening and for applying the insights gained for future teaching experiences. So teachers need to think about many questions before his/her teaching like, What responsibility do I feel in the presence of the child? What does the child need from me? How can I offer the child what he or she needs?

Can I differentiate what the child needs from what he or she wants? How can I act responsibly to serve this child? What teaching methods do I have at my disposal that may be of help? Am I willing to make sacrifice to respond to the child? Am I willing to change my habitual way of doing things to respond to the child? Am I willing to give up a cherished idea about how to teach and move to a new one to serve the child? So, reflection is looking back on teaching and learning to detect patterns that are responsive or unresponsive to the learner, and that may be effective or not effective in helping the learner to learn. Carpenter, Franke and Levi (2003) state, learning mathematics involves activity within a community. It entails "how to generate … ideas, how to express those using words, and symbols, and how to justify to oneself and to others that those ideas are *meaningfully* true" (as cited in Pokhrel, 2011, p.45, *my emphasis*).

As per my reading of contemporary perspectives (Luitel, 2009, p. 336), 'new pedagogy' (student centered teaching) helps to create and develop attention of the students and respect for students' background and develop understandings of and beliefs on elements of the domain. They focus on development of students' meta-awareness and their own understandings and learning process. 'New learning' (constructivist learning) and traditional pedagogies (teacher centered teaching learning process) are different and new pedagogies are more helpful for students. Most of them are student-centered. But in our context, I have experienced that many of us are still following traditional teaching learning process. I have met many teachers who still believe that there is no alternative to chalk and talk method in mathematics teaching. Have I ever tried to teach student rather than curriculum or text book? I never tried to touch students' feelings towards mathematics and never tried to address those students' problems who had feelings of mathematics anxiety.

My Research Goal

When I think about my mathematical journey, I felt a need to express various critical moments of my life like my socio-economic condition of my family, my parents' beliefs towards me and my mathematics, my teachers' beliefs about mathematics, my own personal beliefs and values, surrounding culture, social norms and values, our existing situation on school mathematics, teaching methods etc. In my research question, I have used the word 'good' to refer to meaningful learning of mathematics in terms its processes (that learning has to be joyful) and outcomes (that learners need to demonstrate what they have learnt.

Principal Research Question

1. How could I become a good mathematics learner/teacher?

Sub Research Questions

1. What hindering and facilitating factors might have influenced me to understand mathematical 'concepts'?
2. How might socio-economic systems influence me to learn mathematics?
3. How might parents' and teachers' belief system affect me to learn/teach mathematics conceptually?
4. How can I shift my paradigm from traditional to constructivist mathematics learner/teacher?

Significance

Autoethnography takes me into the world of reflection on my practice as a student and teacher of mathematics. Examining my own beliefs about mathematical learning strategies gives me opportunity to reflect myself as a good mathematics learner and teacher. It will help me to develop as a transformative learner and critically examine my values and beliefs; examine how our life worlds have been

governed. It will help to change my deep structural shift on the basic premises of thought, feeling and action. That shift involves my understanding of me and my self location, my relationship with society, my relationship with culture. From this research, I will also be able to see the power relation within a 'society'. As the narratives attempts to kindle conversation with the readers, this research aims to enmesh the students, teachers and parents to a reflective practice. It is through engaging in the act of pedagogical thoughtfulness that students and teachers find themselves critical knowledge about teaching and learning, about themselves, and about the learners/teachers.

Chapter Outline

Chapter One incorporates instigation of research issues, methodology, research method, theoretical referents and quality standards followed by ethical issues that help me as researcher to guide my research project further.

Chapter two presents some hindering and facilitating factors for conceptual learning and teaching mathematics process. Different scenarios of my experiences present different influential factors; socio-economic factors, parents' belief, teachers' belief, cultural practices, and my own beliefs of learning/teaching mathematics.

Chapter Three presents how economic factors might have influenced me for getting conceptual mathematical knowledge. I have attempted to present various influential economic factors regarding how different economic situations could create different learning environment during my life span.

Chapter Four shows the relationship between teachers' belief system and contextual mathematical learning. In this chapter, some of the stories of my life experiences present how different mathematics classroom with different beliefs could influence in my teaching and learning mathematics process.

Chapter Five shows my journey of transformative thinking from de-contextualized mathematics to contextualized mathematics. This chapter also shows how I transformed my journey from traditional beliefs to new beliefs of learning and teaching mathematics. In this chapter, I have presented some classroom scenarios which I faced in my teaching/learning process.

Chapter Six shows my transformative journey of teaching and learning mathematics. In this chapter, I have discussed and presented narratives which might be the influential factors of my conceptual mathematical understanding. It also offers my critical reflective journey in terms of teaching mathematics. It also presents the lived experience of how a novice mathematics teacher transforms from his old worldview of mathematics to new worldview of mathematics.

Chapter Seven shows my conclusion and learning from this autoethnographic research. I have presented how I changed my attitude towards teaching and learning mathematics. This chapter also shows my future direction and my new paradigm of teaching and learning mathematics. I am also trying to show myself as a novice critical teacher researcher as well as reflective practitioner in this concluding chapter.

Chapter Summary

This chapter incorporates background of my research issues. It aims to address the research questions to be addressed during the research endeavor and the significance of the research. It also briefly presents the chapter outline of entire research project.

CHAPTER I

RESEARCH METHODOLOGY

Chapter Overview

In this chapter, I am trying to shape my research according to my research methodology. This chapter presents my research methodology, research method, quality standards of my research, my ontology of research, epistemology, ethical issues, and different theoretical referents together with data sources of my research. This chapter shows overall framework of my research.

Doing Without Knowing

I had done many inquiries without knowing the word research. In my academic and non- academic journey, I performed a number of tasks without knowing the word research sometimes as a project work, sometimes as a solution of daily life problems, sometimes as a field study and sometimes as a particular case analysis. At the very beginning of the M. Ed. study, I came to know about the word research and I thought that research should be done within the positivistic paradigm. According to positivistic paradigm, "Research may be defined as the systematic and objective analysis and recording of controlled observations that may lead to the development of generalizations, principles, theories, resulting in

Research?

Dreaming about knowing
Thinking about knowing
Communicating about knowing
Doing about knowing
Reading about knowing
Writing about knowing
Finding about knowing
Shaping about knowing
Reflecting about knowing
Transforming about knowing
Acting about knowing
Inventing about knowing
Meaning making about knowing
Generating about knowing
Developing about knowing
Knowing about knowing

prediction and possibly ultimate control of events" (Best & Kahn, 1999 as cited in Belbase, 2006, p. 4). Furthermore, "Research comprises defining and re-defining problems, formulating hypothesis or suggested solutions; collecting, organizing and evaluating data; making deductions and reaching conclusions; and at last carefully testing the conclusions to determine whether they fit the formulating hypothesis" (Woody as cited in Kothari, 2008, p. 1).

But I found other views about research. If I try to get the meaning of research, then I might get different views according to different research paradigms. For me, research is always carried out by an individual with a life and a life-world, a personality, a social context, and various personal and practical challenges and conflicts, all of which affect the research, from the choice of a research question or topic through the methods used, to reporting of the research outcome (Bentz & Shapiro, 1998). Shrestha (2011) states citing the Oxford Dictionary, research (a noun form of language) means, "A careful study or investigation, especially in order to discover new facts or information" (p. 1073). So, I had done many "researches" in the journey of my life. Every experience provides me with new information which is part of research. I argue that instead of experimentation my research inquiry is mainly based on generating knowledge (and probably wisdom) through my experiences of teaching and learning an autoethnographic perspective guided by a specific form of the theory of reality , ontology, the theory of knowledge, epistemology, and the theory of values, axiology (Shrestha, 2011).

Research Methodology

This study deals with subjective and objective realities, and thus, is considered a study of self in the context of other. This is an autoethnography and my own lived experience is at the centre. My voice, feelings, beliefs, emotions, values and

reflections on my experiences are crucial in meaning making. I put my experiences as narratives. Narrative logic and genres are important means for thinking through multiple dimensions of life-worlds (Quicke, 2010).

My body and the bodies of others
My colour and the colour of others
My language and the language of others
My country and the country of others
My relatives and those who I know
My relatives and those who I don't know
My soul and the soul of others
My spirituality and the spirituality of others
The others are me and I am the others

(Cupane, as cited in Taylor, 2012)

Autoethnographic research method is an insider's methodology in which my personal and professional experiences become the key basis for this inquiry (Luitel, 2009, p. 35).Thus an autoethnographic methodology subscribes to the view that reality is constructed through the depiction of the researcher's experiences in a cultural context (Spry, 2001, 2006). Autoethnography combines ethnographic and autobiographic perspective to direct the researcher's heartfelt inquiry into the historical roots of his/her own cultural situatedness and identity (Taylor, 2012). Denzin and Lincoln (2005) state that autoethnography is flux moment between story and context, writer and reader, crisis and resolve. It provides the moment of ability (self reflection), connection (between the theory and practice) and change (teaching practice) in personal and professional lives.

Qualitative Research

Qualitative researchers (those who subscribe to non/[1]positivistic approach) deploy a wide range of interconnected interpretive practices, hoping always to get a better

1. Of course, positivism is very much disempowering but it cannot be left. There are certain assumptions that still play an important role in Qualitative research

understanding of the subject matter at hand. It is understood, however, that each practice makes the world visible in a different way. The central ideas guiding qualitative research are different from those in quantitative research. The essential features of qualitative research are the correct choice of appropriate methods and theories, the recognition and analysis of different perspectives, the researchers' reflections on their research as part of the process of knowledge production and the variety of approaches and methods (Flick 2006). Denzin and Lincoln (2005) state that qualitative research involves the studied use and collection of a variety of empirical materials – case study; personal experience; introspection; life story; interview; artifacts; cultural texts and productions; observational, historical, interactional and visuals texts – that describe routine and problematic moments and meanings in individuals' lives. This really envisioned in me the plot of my research inquiry.

Method

This study is an autoethnography that enters into my own lived experience as a mathematics learner and teacher. Autoethnography comprises three words- auto, ethno and graphy which signify the textual representations of one's personal experiences in his/her cultural contexts (Luitel, 2009, p. 35). Autoethnography provides opportunities to the development of learner and teacher as well and to understand the very possibility of the method that arises from the embodied nature of researcher's experiences. It leads to the preoccupation with the self over the fact that the self is an effect of the individual or collective dialectic; and easily obtains an air of self-indulgence in one's feelings, and the like. As I read Roth (2005), I understood

---

traditions. The slash '/' represented the connection between two set of worldviews.

autoethnography is a legitimate way of establishing inter-subjectivity that escapes the false dichotomy opposing subjectivism and objectivism. Autoethnography methods enacted together with radical doubt are important aspects in making rigorous any disciplinary method. Autobiographical research refers to a family of related forms of self study, including autoethnography (Ellis, as cited in Belbase, 2006).

An autoethnography, perhaps, seems to be one of the appropriate methods of study my own practice as I am the primary source of data. It involves critical investigation of the self that constructs reality as I make sense of the perplexing experiences as a learner of mathematics. My values, beliefs, emotions and voice are crucial in the making of meaning as I become reflexive about my learning/teaching practices. My autoethnographic genres of writing and research display multiple layers of consciousness connecting the personal to culture. My research texts are likely to engage readers in imagining themselves in one or many possibilities of their autobiographical selves. As a form of ethnography, it involves the study of how the individuals define reality and experience events and make sense of the self in the social context. My values, beliefs, emotions and voice are crucial in the meaning-making as I explore reflexively on the underpinning beliefs which may become potential influences in my learning practices. This autoethnographic research is also very much useful tool for improvement of my personal and professional practice. Emancipation and liberation are the key points of this research. The notion of the dialectic becomes important only within a commitment to emancipation, one that seeks to liberate … in both subjective and objective terms (Taylor, 2007).

Arts-informed research is a way of redefining research form and representation and creating new understandings of process, spirit, purpose,

subjectivities, emotion, responsiveness, and the ethical dimensions of inquiry (Cole & Knowles, 2008).Taylor and Wallace (2007) have written,

> Art-based modes of expression provide unique opportunities for contemporary qualitative researchers to portray the process of coming to know in thoughtful, emotional, and spiritual terms, enabling them to express heartfelt moral concerns about the need to transform the sometimes parlous state of science and mathematics education (p. 4).

The arts make to knowledge has to do with empathic feeling (Eisner, 2008). Further Eisner states, empathy is a means to understanding, and strong empathic feelings may provide deep insight into what others are experiencing. In that sense, the arts in research promote a form of understanding that is derived or evoked through empathic experiences.

Critical Research Paradigm

The ontological, epistemological and methodological considerations of critical research paradigm are ‘historical realism’, ‘transactional and subjectivist’ and ‘dialogic and dialectical’ (Guba & Lincoln, 1989) respectively. The present shape of reality is taken as the transactional and subjective reality. The main role of critical researcher is to be changing agent of society. Positivistic paradigm offers no space for articulating the researcher's unfolding 'self' during the research process (Luitel, et. al., 2012). So, I have chosen critical research paradigm as my research paradigm.

The paradigm of criticalism uses a transformative ontology of critical selfhood (Kincheloe, 2003) and enables me to critically examine assumptions, values and beliefs invisibly embedded in my thinking and action (Kincheloe, 2010). This research aims to critique many ‘status-quo’s and offers a vision of transformed reality that promotes social justice. So I have chosen critical research paradigm to

critique status quo in mathematics teaching and learning process. My values go to my historical journey of teaching and learning mathematics.

Interpretivism

In this research, I have included interpretivism as a supportive research paradigm. Interpretivism has emerged in the social sciences to break out of the constraints imposed by positivism. Interpretivism, as Taylor, Settelmaier, and Luitel (2012, p.) claim, "is concerned primarily with generating context-based understanding of people's thoughts, beliefs, values, and associated social actions". Interpretive paradigm focuses on action. "Actions are meaningful to us only in so far as we are able to ascertain the intentions of actors to share our experiences" (Cohen, Manion & Morison, as cited in Gurung, 2011, p. 15). The interpretive paradigm demands a set of feelings and beliefs that the researcher has about the world and how it should be understood and studied (Gautam, 2011).

As an interpretive researcher, I have attempted to seek for clarification, understanding, and extrapolation to similar situations of the status of reflective writings in my research. Interpretivism is characterized by a belief in a socially constructed, subjectively-based reality- one that is influenced by culture and history. "Epistemologically, interpretivism gave rise to two key epistemic metaphors so as to guide my research journey: knowing as interpreting and constructing (Luitel et al., as cited in Luitel, 2008, p. 31). With its emphasis on the relationship between socially-engendered concept formation and language, it could be referred to as the interpretive paradigm.

Postmodernism

Although the paradigm of my research is more oriented towards criticalism, I have employed postmodernism as a supporting referent for knowing through multiple

forms of epistemic metaphors, expressions, and logics. Since the paradigm of postmodernism promotes epistemic pluralism (Gautam, 2011), I hope to have used the propositional-analytical logic with giving due emphasis on alternative-inclusive logics such as poetic, narrative and metaphorical logics, which help me take my journey further through this complex nature of knowing, being and valuing within this paradigm (Luitel, 2009). In the same way, it enabled me to construct multiple genres for cultivating different aspects of my experiences. Lamichhane and Wagle (2008) say that postmodernism favors mini-narratives that explain small practices, local events, rather than large scale universal or global concepts which are always situational, provisional, contingent and temporary, making no calm to university, truth, reason or stability (p. 9). Klages (2007) says, "In a post-modern context, however, knowledge becomes functional you- learn things, not to know them, but to use them". (as cited in Kunwar, 2009, p. 24). Thus I have tried to present some narratives knowingly and unknowingly, but I had practiced them before with my cultural meanings. Mirchandani (2005) says,

> From postmodernism, seen as a combination of epistemological and empirical moments, we get the ability to continue living modern lives: making hypotheses, collecting data, and drawing conclusions, given backbone and confidence by sets of new conceptual tools and also a renewed modesty about the absoluteness of our findings or conclusions (p. 110).

Ontological Consideration

My notion of reality about this research is multiple. Different learning and teaching strategies are my assumptions. Ontology of change/motion rather than ontology of rest/statics is my preference thus my assumption of reality is related to

complexity science. Ontological assumptions concern the very nature or essence of the social phenomena being investigated (Cohen, et al., 2002). My subjectivity (being and becoming) is represented by a style of research writing that is largely emergent.

Epistemological Consideration

Epistemological considerations are the very basis of knowledge, its nature and forms, how it can be acquired and how it can be communicated to other human beings (Cohen, et.al, 2002). I used stories, poems and different art-based writing of my experiences as a mathematics learner/teacher and try to reflect it critically in my own learning experiences. I used performative story rather than descriptive. Performative genres can be defined as an appropriate means for highlighting the praxis-oriented function of research texts, which helps me to take a standpoint of an active knower rather than an objectivist conformer of pre-existing knowledge (Maude et al., 2011). For this I have included different stories, pictures and narratives (and poems as well) for different situations of life fractal.

Data Sources

My research is an autoethnography. So I am the primary source of data. My data sources are narrative writing, diary, reflections, my different historical images, story and some semi-factual writings, different art-based writing and pictures. The central purposes of arts-informed research are to enhance understanding of the human condition through alternative (to conventional) processes and representational forms of inquiry, and to reach multiple audiences by making scholarship more accessible (Cole & Knowles, 2008).

Quality Standards of My Research

My research cannot be judged exclusively by the quality standards based on positivism. Validity, reliability and objectivity are not appropriate for my research.

My standard arises from the critical research paradigm. I have used verisimilitude, pedagogical thoughtfulness, emergence and critical reflexivity for this research. The standards for this autoethnography are art-based rather than science-based. I have included stories and narrative writing in order to represent [my] self and other cultures.

Verisimilitude

As cited in Pandey (2010), Marcus (1994) asserts verisimilitude as a set of laws set by conversation and as a mask that presents these laws as a text's submission to the rules of a particular genre. It describes a text's relationship to reality and it asks some questions about representations in a text consistent with real and about the truthfulness of text. He further clarifies, "Verisimilitude can be described as the mask a text assumes as it convinces the reader it has conformed to the laws of its genre; in so doing it has reproduced reality in accordance with those rules" (p. 580).

In the process of judging the fulfillment of this quality standard, readers of my autoethnography can feel my stories as valuable and they can feel and think about the reality of their lives in relation to mine. My stories might show some similarities between me as researcher and my dissertation reader.

Critical Reflexivity

I hope to have examined my false consciousness in my chosen epistemology, methodology and theoretical referent. From critical research paradigm, critical

reflectivity as a quality standard can judge my assumption as a researcher, my subjectivities and my textual construction for future use of mathematics education research. My critical reflexivity represents the quality of my knowledge construction process. I hope to have explored my personal 'political' agenda and disclosureness of the past to some extent. So, the idea of critical reflexivity entails the notion of exposing myself as well as being self-conscious of my own (unfolding) subjectivity (Luitel, 2009).

Pedagogical Thoughtfulness

For this quality standard, I have tried to engage readers of my research and invite them to reflect on their own practice through this research. Thus, I hope to have addressed pedagogical thoughtfulness (Van Manen, 1990) as a quality standard in my research by generating evocative, perspectival and dialogic texts.

Praxis

With my stories portraying my experience as a learner, I invite the reader to judge whether I have demonstrated a possible state of raised consciousness about teaching and learning of mathematics. I hope to have critically examined most important issues of the surrounding the culture of my learning.

Emergence

For this quality standard, I have tried to show my lived reality to readers of my research. Our lived reality is always in the process of change, adaptation and emergence (appearance of constructs, ideas, activities, phenomena in the teaching-learning process) (Luitel, 2009).The quality standard of emergence in autoethnography and self-narrative has been very important for judging the merit of research in terms of possible progressions in my ideas and perspectives during the time of research. I propose that the task of engaging in complex conversations is a

way to invite multiple perspectives, seeking interactions that might lead to transformations, and allowing for emergence instead of controlled, prescribed conclusions (Smitherman, 2006). The paradigm of interpretivism has enabled me to employ emergence as the hallmark of my inquiry (Luitel, 2009). If teachers engage in mathematical conversations that work to decenter the teacher, then the emergence of understanding becomes shared (Smitherman, 2006).

Ethical Issues

Autoethnographic research generates fears, doubts and emotional pains, especially in the context of the regime guarded by positivism. There are two types of ethical position; absolutist and relativist ethical position (Cohen et al., 2000). The absolutist view holds that a clear set of principles should guide the researchers in their work and that these should determine what ought and what ought not to be done. But a relativist position would argue that there can be no absolutist guidelines and that ethical consideration arises from the very nature of the particular research (Cohen et al., 2000). In my field, I am not the only a learner and a teacher of mathematics. So my narratives may speak about many people who came in to consideration. There is vulnerability of revealing myself, not being able to take back what I write or have any control over how readers interpret it. It is hard not to feel my life as a mathematics student and teacher not being critiqued as well as my work. So I have tried to avoid harming myself and others through my writing.

Theoretical Referents

For making my theoritical standpoint clear i have used some theory as my theoritical referents. With the help of some theories and litrature i tried to make my narratives clear to my disseratation readers. Those theories are as below;

Critical Theory

A theory is critical to the extent that it seeks human emancipation "to liberate human beings from the circumstances that enslave them" (Stanford Encyclopedia of Philosophy, 2012). Critical theory offers a multidisciplinary approach to society which combines perspective drawn from political economy, sociology, cultural theory, philosophy, anthropology, and history (Bronner & Kellner, 1989). Thus critical theory can emancipate people from different disciplinary boundaries also. Critical theory is concerned with creating societies free from dehumanizing policies and practices that perpetuate social injustice, cultural exclusion, social inequity, racism, sexism, ageism, scientism and many other forms of repression (Taylor, 2012).Individual is a meaning-maker with contextual sense. Being critical means not only criticizing others, it is a meaning making process through reflexive voice of practitioners.

Conceptual Understanding in Mathematics

There are many ways to get humans to learn, but a deep understanding of concepts is not always achieved when teaching. Students often memorize through rote-memorization, but do not conceptually understand because humans interpret their world based on the concept that makes their own understanding of the world also known as their "conceptual framework". I interpret the world based on what I know and often if these preconceptions are not reorganized in my mind. There are several versions of conceptual understanding. In order to release their concrete preconceptions as students, they must find a more satisfying concept. Students must exchange or adjust their own central concept, also known as accommodation and the other form of conceptual understanding when students use their existing concept to interpret a new phenomenon which is called assimilation. The individuals interpret

their own world through their subjective knowledge (the personal creation of an individual). Subject knowledge is the world of our conscious experience. Subjectivity focuses on how individuals are both the subjects in the sense of the actors in a discourse but are also subjected to the possibilities and limitations, the affordances and constraints, of that discourse (Lerman, 2009). So in my research, my subjectivity is the central feature. I represent my feelings and experience in my single views about reality.

Nature of Mathematics and Learning

About the nature of mathematics, there are many views like mathematics is im/pure (Luitel, 2009), formal, logical, intuitionist, symbolic. The feature of symbolic, abstract, algorithmic, and formal mathematics is the view of mathematics as culture-free subject which also can be a politically motivated expression for not incorporating knowledge systems arising from people's practices (Luitel & Taylor, 2007). There are many critical questions related to mathematics learning like; what power of the learners is/or could be developed by learning mathematics? How does the identity of the learner change and develop through learning mathematics? Does learning mathematics affect on the whole person for good or for ill? How are the future mathematicians and the future citizens formed through learning mathematics? How important are affective dimensions including attitudes, beliefs and values in learning mathematics? What is mathematical ability and how can it be fostered?

These questions challenge mathematics teacher, mathematics teacher educator and mathematics student. For the improvement of this, we need to see mathematics and its social relations also. For this, we need to address some critical questions like; what are the aims of mathematics education (i.e. the aims of mathematics teaching)? Are these aims valid? Whose aims are they? For whom? Which values? Who gains

and who loses? How do the social, cultural and historical contexts relate to mathematics, the aims of teaching, and the teaching and learning of mathematics? What values underpin different sets of aims? How does mathematics contribute to the overall goals of society and education? What is the role of the teaching and learning of mathematics in promoting or hindering social justice conceived in terms of gender, race, class, ability and critical citizenship? So many perspectives affect the learning process and they will become a barrier for conceptual understanding of mathematics. But in philosophy of mathematics, there are different views: according to absolutism that mathematical knowledge is timeless, although we may discover new theories and truths to add; it is superhuman and ahistorical. The history of mathematics is irrelevant to the nature and justification of mathematical knowledge; it is pure isolated knowledge which happens to be useful because of its universal validity; it is value-free and culture-free, for the same reason (Ernest, 2001). But fallibilism rejects the absolutist image of mathematics as a body of pure and perfect abstract knowledge which exists in a superhuman, objective realm. Instead, mathematics is associated with sets of social practices, each with its history, persons, institutions and social locations, symbolic forms, purposes and power relations. The fallibilist view does not reject the role of logic and structure in mathematics, just the notion that there is a unique, fixed and permanently enduring hierarchical structure. Instead, it accepts the view that mathematics is made up of many overlapping structures which, over the course of history, grow, dissolve, and then grow anew, like trees in a forest.

When I started to learn mathematics, I understood mathematics as foreign subject (Luitel, 2003) because there were not any related examples from our context. So I understood that my practice was sufficient or it was the ultimate truth for mathematics at that time. In history, mathematics is taken as distinctive tool for social

problem solving practice and also means of political power (Keitel, 2009). The most important knowledge conflicts at educational systems are clashes between students' personal knowledge and the knowledge presenter by teacher, between knowledge system, between modern and traditional system and between teachers and students (Keitel, 2009). Contextual meaning making is also important for mathematics learning. Without context, no one understands and practices any types of mathematics. Truth is a moment of and practice that I perform in contexts (Kincheloe, 2008).

Constructivism

Constructivist theory emphasizes on the pedagogical importance and focuses on the learner's cognitive and social meaning making processes (Kincheloe, 2004). My orientation focuses on mathematical knowledge construction process and knowledge construction strategies for learner as well as teacher. The foreign mathematical content is to be delivered to compliant students, rather than a means of enabling students to make sense of their culturally situated experiential realities (Taylor, 2008). The general sense of constructivism is that it is a theory of learning or meaning making; the individuals creates their own understanding on the basis of an interaction between what they already know and believe and ideas and knowledge with which they come into contact. Constructivism, reduced to its most basic element, is simply a learning or meaning-making perspective. This theory proposes that people create their own meaning by understanding, combining what they already know and believe to true with new experiences with which they are confronted (Richardson, 1997). Students can remember the things or matter if they do this by themselves. So learning by doing (Scheneider, 2000) is important theory for every mathematics teacher and student. So this pragmatism focuses on self-directed learning.

According to Vygotsky (1986), learners first construct knowledge in their interactions with people and activity contexts. From this perspective, knowledge and learning are considered to be social activities which are mediated by cultural artifacts and resources. This approach centers on the ways in which power, the economy, political and social factors affect the ways in which groups of people develop understanding and formal knowledge about their world. These bodies of knowledge are not considered to be objective representation of the external world (Richardson, 2003) while Vygotsky (1986) writes negotiating means both materials and symbolic resources. Overtime and with repeated experiences with others in social interaction, the learning becomes internalized by the individual and social becomes the psychological. As mentioned by Upadhyaya (2008), Von Glasersfeld states, "Knowledge is the result of an individual's subjective constructive activity, not a commodity that somehow resides outside the knower and can be conveyed or instilled by diligent perception or linguistic communication" (p. 2). My understanding of the basic notion of constructivism is to construct knowledge actively from the milieu rather than to receive knowledge from it (Glasersfeld, 1995).

Quale (2006) further focuses that radical constructivism is fundamentally a relativist theory like any other cognitive knowledge, and the conception of truth as an objective descriptor of the world. This conception is replaced by that of viability as providing a better descriptor of the knowledge that is continually being constructed by the knower. Even radical constructivism itself does not claim to be correct or true. It rejects the notion of truth-in-itself, and takes the position that propositions can only be regarded as true or false relative to a context. Radical constructivism accepts that we share our experiential world with other individual knower. The learning context may be different. The situation for learning mathematics depends on the experience of the

individual adult with mathematics in school and everyday practice and their individual perspectives for learning. Emotional factors are just as important as cognitive ones in the psychological learning process (Wedge, 1999). So, individual perceptions and experiences are the central of every mathematical learning process. There are broad areas for understanding learning process; one is that perspective learning as a psychological process (cognition) is being investigated, and from another learning as a process of interaction (social learning). Effective cognitive functioning requires reliable ways of distinguishing between accurate and faulty thinking (Bandura, 2001, p.267). The traditional psychological theories of learning share important features. They are based on a number of dichotomies between inner and outer; knowledge is considered as exclusively some- thing to do with the brain, and the individual is taken as the unproblematic point of departure for learning processes (Wedge, 1999). But social learning is mostly related with classroom practice. It tries to address everyday classroom problem as a social entities.

Variation Theory

As I have gone through Runesson (2005), I came to know about the variation theory. Variation theory has its roots in phenomenographic research which accounts for how the same things or same situation can be seen, experienced and understood in a number of qualitatively different ways. Some ways of experiencing are more powerful than others (in relation to certain aims). So the way something is experienced is fundamental to learning. Variation theory seeks to account for differences in learning and describes the conditions necessary for learning. From a variation theory position, learning is defined as a way something is seen, experienced or understood. Central to this theoretical position is that the learner, in one way or the other, experiences that which is learned.

Education aims at developing the learners' capability to handle various situations; to solve different problems and to act effectively according to one's purpose and the conditions of the situation. However, the possibility of acting on, or handling a situation depends upon how we make sense of it. We act in accordance with how we perceive the situation. This is made by our previous experiences, but the experiences we see as relevant are also affected by how we experience the situation. I try to achieve my aims not in relation to the situation in an objective sense, but in relation to how I see it. The main aim of this theory is the object of learning, that is, there is no learning without something being learned. So learning always has an object. The second aim of this theory is to demonstrate and argue for the importance of taking the object of learning into consideration when trying to understand teaching and learning mathematics. I have already faced those types of learning because of which this theory seems to be relevant to my research.

Transformative Learning

Transformation comes from understanding the system of profound knowledge (Daszko & Sheinberg, 2005). The transformed individual perceives new meaning to his/her life, to events, to numbers, to interactions between people. Once the individual understands the system of profound knowledge, he/she will apply its principles in every kind of relationship with other people. Transformation is not for the other person to do, but for every individual to take personal responsibility to help create new futures, to ask questions, to take risks, and to make a difference. According to Daszko and Sheinberg (2005), transformation occurs when people create a vision for transformation and a system to continually question and challenge beliefs, assumptions, patterns, habits and paradigms with an aim of continually developing

and applying management theory, through the lens of the system of profound knowledge.

Transformation happens when people managing a system focus on creating a new future that has never existed before, and based on continual learning and a new mindset, take different actions than they would have taken in the past. Transformation is an integral process incorporating survival, critical resistance, and creativity (Mezirow, 2009, p. 36). In conclusion, transformation is the creation and change of a whole new form, function or structure. To transform is to create something new that has never existed before and could not be predicted from the past. Transformation is a "change" in mindset. It is based on learning a system of profound knowledge and taking actions based on leading with knowledge and courage. While people who have been oppressed do not always have control over their situations, they do have some command over their emotional reactions. They can internalize the oppression or choose to see themselves as a change agent and explore new ways of responding (Mezirow, 2009, p. 39). It is critical because assumptions and paradigms drive policies, procedures and most importantly, systems and structures. In teaching learning environment, teachers' reflective practice is necessary as teachers need to reflect on their practice; they need to think about their work, action, thinking, etc. If they. Unreflective teachers tend to accept everyday reality, work only to find the means to carry out most effectively the ends demanded by their culture, which leads to further enslavement for it leaves the person at the mercy of appetite, sense and circumstance (Cook, 1998).

Chapter Summary

This chapter incorporates wide array of research issues ranging from autoethnography as a method and methodology, critical research paradigm; verisimilitude, pedagogical

thoughtfulness, praxis and critical reflexivity as rigor of criteria; critical, variation theory, constructivism, transformative learning as key theoretical referents to dealing with ethical issues to be addressed for the research. In addition to it, I have also touched upon interpretive and postmodern research paradigm to some extent to support my research paradigm which I realized as contributing paradigms during the research journey.

CHAPTER II

MAPPING OUT MY JOURNEY- A LIFE FRACTAL IN MAKING

Chapter Overview

This chapter portrays my journey as a mathematics student to a novice mathematics teacher. In this chapter, I am going to portray different empowering and hindering factors which might have influenced me to understand mathematical concepts as a mathematics student. In my lifetime, I have learned so many mathematical concepts knowingly and unknowingly. Thus, I think it is very important to explain about my physical, cultural and familial situations (where I was locating) before explaining about any factors. To become a mathematics education researcher, I have passed different stages of life with mathematics in my cultural context. While I was passing my different stages of life, I was suffering from different problems. In this section, I would like to present my experiences ranging from home (before formal education) to university taking into consideration how I was treated as a learner, how I got different types of mathematical representations from my socio-cultural, economic and geographical background. Furthermore in this chapter, I have recollected the nodal moments of my teaching experiences as a novice teacher who loves activity-based mathematics teaching learning process. Thus, I am going to explore different influencing factors from the themes below;

- My childhood with different social activities
- My journey as a mathematic student
- Mathematics in relation to my context

- My mother as a teacher
- Natural way of counting and its relation with my learning of mathematics
- Teacher's image and student's belief in mathematics classroom
- My journey as a novice teacher

My Childhood with Different Social Activities

I was born in a joint family as the third child at the village of *Parauta*[2] in Khadwa Bangai VDC, Ward number three, Rupandehi, Nepal. And I stayed with my grandfather, uncle, auntie, cousin brother, sister, and my own family. My childhood was very much interesting as I spent the most of my childhood period with different games and activities. My father had his own business and also a government job. He had a business related to paddy, wheat and rice. That time we had a rice mill. To retrospect, I spent most of the games with my cousin brother *Pursottam*[3] in the mill then. Hiding and seeking in a paddy sack was our utmost favorite game among many others. We were spending for our own games playing in groups that helped shaped my mathematical knowledge from the very beginning.

[2] Name of village in KhadwaBangai VDC, Rupandehi, Nepal

[3] Name of a person

I had done my mathematics with different playing groups of my society as what Scribner (1984) argues that mathematics of different groups in everyday settings showing that mathematical knowledge is generated in a wide variety of contexts by both adults and children. My father was an 'educated' person (as he completed university education) but my mother did not attend the school. Nevertheless, she could read and write properly. In addition to a government job and business, my father had an experience of measuring land also. Before joining the school, I saw his land measuring activities many times and his calculation in an inquisitive manner without having any knowledge and understanding about calculation and land measurement. Every person of my society would call him for land measurement whenever they wanted to purchase or sell the land.

One day, I went to my neighbor *Bimal's* (one of my friends) home and saw a slate and he was writing on it with chalk. That time, I saw his different geometrical creations on slate. Suddenly I returned back home and started to demand slate and chalk with my mother. She told me that I was not able to write then as I was too young/small enough to read, write and study. She also told me to rather play different games with my friends. In the evening time, my father returned back home and I asked him to buy slate and chalk for me as I wanted to learn mathematics as my friend, Bimal. However, he promised and bought me a new slate and chalk home after two days. From that day onwards, I started to play by writing games on slate. I tried to make a straight line but remained unsuccessful despite my hard practice for a number of times. After practicing for several times, I got an idea to draw straight line with a chalk on the slate. It was very difficult to make straight line from curve line in the beginning stage of learning. After making straight line, I started to make different shapes. I was excited to show my creations to my brother and sister. My brother and

sister always encouraged me for those kinds of activities. I learned different kinds of mathematics being engaged in different kinds of work and playing games at home within my family sometimes with my friends, brother and sister.

My Journey as a Formal Mathematics Student

Although it is very difficult to remember all the past activities, I am trying to reflect on my past experiences as a mathematics student or a mathematics teacher. I started learning mathematics from 2047B.C. (1991 A.D.). I joined the village school at *Shree Shishai primary school*. It was located in Khadwa Bangai VDC, ward number 9 in Rupandehi district which was managed by the government. In each classroom, we were nearly twenty students and more than 80% students were from *Madheshi* (People from *Terai*[4] in Nepal) background. Their main language was Madheshi and it sounded like *Bhojpuri*[5] language accent. So, I learned many things from Bhojpuri language (local language of *Tarai* region of Nepal) even though curriculum prescribed that national language is Nepali. At that time, our country had just undergone political transformation from *'Panchayati system*[6]*'* to multi-parties democratic system of governance. I started my learning in such a transitional period

[4] Southern region of Nepal

[5] Language spoken in Northern part of India

[6] Government ruled by theKing

of Nepali politics. In our school, most of the teachers were from *Madheshi* community. So they did not perform Nepali language very well in terms of speaking and writing. Because of such a reason, I learned mathematics forcefully in mixed language, or say, bilingual context.

Still I can remember my grandfather's counting of paddy by using *shei* (one shei makes one kg and four *shei*[7] makes one *pathi*[8], twenty *pathi* makes one *muri*[9] in *Terai* region of Nepal). That time, there were not any measurement scales. My grandfather counted paddy many times like *rama*[10], *duwa, tina, chara, pacha, chhaya, saata, aathha, nawe, dasam*- these are the numbers from one to ten respectively. These are our traditional counting numbers. According to Lerman, (2006), cultural prospective sees all meanings as socially produced, physical experiences too being interpreted through the local cultural practices. Individuality is the expression of the unique set of socio-cultural experiences, gender, class, ethnicity etc. It means that all knowledge industries are attached with our society and culture and, thus, we can make mathematics meaningful by relating it with our own context.

My mathematics learning experience during my childhood was not without problems due to lack of facilities of electricity at home as I was unable to 'practice' (as if it is a blind faith) mathematics at night. That time, we used kerosene lamp to get rid of darkness and do some activities like reading, writing at night.

---

[7] approximately 1 kg

[8] approximately 4 kg

[9] Approximately 80Kg

[10] Counting numbers from one to ten

Most of my teachers in primary school had completed their education from India. So I experienced the gap (my teachers were unable to deliver mathematics properly because of the emphasis of our curriculum on content?) between Indian curriculum and Nepali curriculum. But my grandfather was very clever. When I was child, my grandfather was managing the rice mill and I would observe his counting method. Sometimes, he asked me to count sacks of paddy, sacks of wheat, sacks of rice etc. So I would count them all. As my father had a government job, whole day he collected money from different ways for various official purposes and he would ask me to count all the money at night. All those aforementioned examples were markers of my learning mathematics from my early childhood out of which I learned counting properly and more efficiently perhaps. Now, I do remember how I practiced subtraction of numbers during that time. And I also do remember *Haatbajar*[11] set up in different locations during different social and cultural events. From *Haatbajar,* people, the inhabitant of *Tarai* would buy their necessary things for one week. I would go to attend *Haatbajar* with my brother every week and there I learned subtraction by shopping goods. My mother would lend me money for *Haatbajar* every week and there we could spend money according to our choice. From all those activities, I practiced addition and subtraction.

Game is also very much important for every child. From the game, a student can learn mathematical concept easily. I can remember that I learned multiplication table more with rubber game than from my school teaching and learning activities. Our teachers made us practice like copy and paste activities that I actually did not like. Thus I am unable to remember my initial practice for divide activities. Until my

---

[11] Local market organized weekly at particular villages

study at the Grade Five, I was very good in both qualitative and quantitative part of mathematics. I am using the term ‘Qualitative’ for conceptual understanding in mathematics and quantitative word for using marks obtained in mathematics. When I was in the fifth grade, suddenly our family suffered from many problems because of my father's untimely death as he was the sole source for the survival of our family. After that, I changed my school because my previous school was only up to the Grade Five. I went to a big school in city area where I found many differences. There were many students in a class which was absolutely amazing for me. I became a care free student. I started to ignore homework, leave classes in the school. I started to play carom board outside the school. I never informed my mother about my progress and I got just pass marks in mathematics as a result. After that, my sister started to ask me question like this; *"You are the student who got good mark in the fifth grade. But how did it all happen?"* I could not give answer because the answer was easy that it was all because of playing carom board and by not attending regular classes at the school and the same thing continued in the seventh grade also.

Now I become a teacher and I still could remember painful processes which were ‘delivered’ by my teacher during my student life. In my classroom, I try to teach my students according to their interest and abilities. I have used (with some success) games mostly in mathematics classroom. However, I never developed the clarity of concept of mathematical problems during my student life of learning mathematics which was full of anxieties. Rote memorization was the main source of learning during my school day. Thus, I want to share some events from my situation which may represent my condition of learning.

Mathematics in My Context

It could be any day of May in 1993, we (I and my friends) went for goats grazing in the *Khet*[12] at around 8:30 am after having breakfast. Sometimes, some of our goats went on grazing to others field and we would gather them all time and again. All of us came there separately, but after sometime we mixed all our goats and counted our gathered goats and found odd numbers of goats. Then we started to play foot ball there. We (my friends and me) played football nearly for two hours. After that my mother called me for a lunch. I went to home and spent 2 hours there. At that time we would go home in rotation for lunch. Sometimes we went home for water and sometimes for food. When I returned there, I found again even number of goats. But one of my friends told me later that his father took two goats for selling purpose. I was surprised by my counting system. That time the entire goats were counted in pairs. When I found one extra goat from the pairs, I thought that there were all goats present. I was surprised how I got again all the goats even after two of them were taken out from the herd of goats. And looking back to those by-gone days, I think that my counting was not wrong but my concept was possibly wrong because I was not clear about odd and even number until those days. However, I had some knowledge and awareness about pair of things.

It was only after I developed conceptual knowledge of mathematics in a clearer way after being admitted to a school where our mathematics teacher taught us about odd and even number and he taught us that all the multiples of two are even number. To clarify, he joined even numbers with pair of objects. He gave us many examples with their pairs and told us that all the pair numbers are even numbers. I did

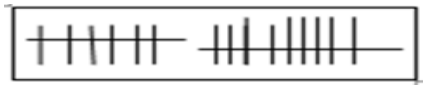
---

[12] A field for growing various crops

many more activities in the classroom using our local examples within the group. After knowing addition and subtraction of odd and even number, I realized my mistake in counting the goats in those goats grazing days. This made me realize that every mathematics teacher can relate mathematics with their local context. If the teacher relates mathematics with our local context, we can get conceptual understanding of mathematics easily. However, many of our teachers were teaching odd and even number by merely using mathematical numbers and claimed that their students were brilliant in mathematics. Is it possible?

Counting Through Natural Way

In this section, I would like to share one interesting natural counting method that I saw, learned in my house some twenty years back. There were four permanent workers in my house and their counting systems were different. *Gyan Bhahadur Dai*[13] was one of them who had different way of counting his working days. He always drew lines on wall like tally we do in statistics. Before vacation, he would cross the lines he had drawn before. After some days, my grandfather asked him about the days he was present in work. Then he started to count those lines and



In this figure, Gyanudai counted by drawing lines on a wall. He would draw lines when he continued his work. But before taking rest, he would cross all vertical lines by one horizontal line. From the above figure, we can see that he did seven days at first and took a rest. After taking a day rest again, he started to draw lines on a wall and crossed all lines before taking another rest. So he did it for seven days and took a rest at first and he again did continuously for ten days for the second time and took a rest. In my society, I found this type of counting in mathematics which we call tally in statistics.

[13]Brother

said "I did 17 days during this month". I got this fact from him because I was with him when he counted his working days.

` My grandfather found the same as his counting and gave him money as per the days he spent on work. The individuals interpret their own world by their subjective knowledge (the personal creation). Subject knowledge is the world of our conscious experience. Subjectivity focuses on how individuals are both the subjects in the sense of the actor in a discourse but are also subjected to the possibilities and limitations, the affordances and constraints, of that discourse (Lerman, 2009, p.186). Identity is, therefore, produced in discourses and notion of subjectivity captures that regulation. The subjectivity searches for identity. Finally, Lerman tried to relate the culture and an individual because both are two sides of one coin, culture and society regulate the individual and an individual can generate his subjective meaning by the help of culture and society. Similarly, D' Ambrosio (2001) says;

> Man depends on fundamental nutrition and protection. Knowing about the environment was the first attempt of human to sustain in earth. Consequently he got mastery upon techniques of agriculture, raising livestock and construction of house. Along with all the activities he did try to organize an instrument of analysis of the different conditions. While doing so he would the very basic point of ethomathematics. But the ethnomathematics at different part was different because the condition of nature in different place was different and he had to develop new ethnomathematics in new condition to make himself sustain (p.19).

I argue that mathematics can never be culture-free and it has different meanings according to different cultural contexts. If we try to generate mathematics

from within our social practice, we may get it in an informal way in the very beginning stage. Formal mathematics is an expression of mathematics as culture-free subject which also can be a politically motivated expression for not incorporating knowledge systems arising from people's practices (Luitel & Taylor, 2007). *Gyanu Dai*[14] did not know about formal way of doing mathematics, but he found his solution. He had a different concept about counting. Later, I asked him how he did find that counting method and where he did learn all those concepts related to mathematics but in his own socio-cultural context. Then he said to me, "I got this way of counting from my elders ". Thus, I infer from his reply that every society has its own mathematics which might comprise different types of solving everyday problems.

> *Every living person develops knowledge and behavior that reflects this knowledge, which in turn becomes modified as a function of the result of that behavior. For every individual, his/her knowledge is in permanent transformation and relate to each other in a truly symbolic way*- D'Ambrosio (1990, p. 9)

Teacher's Image and Student Belief in mathematics Classroom

When I was at Class Four, I was a good student of my school. I was much more creative and curious student. I had been involved in sports, quiz, poem writing, debate, singing, dancing, drawing and essay writing activities. I did not know about any more social relations. I knew only one thing about my academic result. My parents were also conscious about my academic result. They always expected my first position in my class. Moreover, my father and grandfather always inspired me for my good academic performance. I did all I could do for my good academic result, but I did not know the actual meaning of what I learned. My marks only validated my

[14] Name of a person, who works for farming

performance in front of my parents which they always expected from me. They did not believe on any other creative activities that I would do during my study. But my half yearly examination of class four inspired me a lot for my mathematical journey since I got only 34 marks out of 40. When I heard my number, I started to cry and I left school for that day. That day I was very much serious because I never got least marks on mathematics. Before that examination, I always got full mark in mathematics. The next day my principal called me and I met him at his office. First, he tried to convince me for my number. But I told him that I did not like my math teacher and suddenly he started to beat me and told me to get out. Then I left his office and I entered the class room when my mathematics teacher was teaching there. He asked me what had happened and I gave a prompt reply that I did not like his teaching method and I told that I got low marks because of him and his way of teaching mathematics. Then he told me not to get worried being the first boy in the class and a brilliant student particularly in mathematics subject. He inspired and encouraged me for algorithmic problem solving because of which his continuous correction helped me to increase my algorithmic problem solving skill. He would assign me mathematical problems in front of class and to write it on the blackboard so as to encourage me more for the development of problem solving. From that continuous pressure, I was able to be a good mathematics student. But he never used suitable contextual examples for mathematics teaching. He used only those examples which were given in the text book. Being a curious student, I felt algebra as my interesting area of mathematics in that class. I liked simplification exercise very much. But regarding indices, I did not get any more sufficient information.

My Mother's Role as a Teacher

When I was a child, my mother would borrow some money from neighbours for our daily expenditure. After some time, she returned that borrowed money with some extra money as interest. That time she would calculate interest on a monthly basis. Our neighbour took Rs 3 interest rate for 100 in a month. If we take 100 from our neighbours, we need to return Rs136 = 100+3 X 12= 100+36 in a year. That means for Rs100, we paid Rs36 interest. Regarding that, I am going to present dialogue between I and my mother below;

My mother: Toyanath, come here.

I: Why are you calling me, mother?

My mother: Give theseRs6800 to *Kaila Dai*[15]*(Kaila Dai* was our neighbour. He was a business man and he lent us loan many times)

I: Why are you giving this money to him?

My mother: Toyanath! Before one year, I borrowed Rs 5000 from him.

I: Is here some extra money also?

My mother: Yes.

I: How much extra money are you giving?

My mother: There is Rs 1800 extra money.

I: Why are you giving him Rs 1800 extra?

My mother: This Rs 1800 is interest of that money of the principal money borrowed as loan.

I: What is interest?

---

[15] Name of a person

My mother: Interest is that extra money we should pay back to the money lender in addition to the actual principal money borrowed. She said to me, 'If we use others money or things, then we should pay them back adding some money on that'.

I: Oh!

My mother: Furthermore, she told that we should pay some amount of money apart from the principal money that we borrow. Like if you deposit our money in a bank, then we will get some extra money after sometime.

I: Ah! So why are you giving exactly Rs 1800 extra money for Rs5000?

My mother: We had an agreement, Toyanath.

I: What type of agreement?

My mother: I already agreed him to pay 3 Rupee for 100 in a month. So I calculated and found Rs 1800.

I: Ok *aama*[16]. Give me all amounts I am going to give it to *Kaila Dai*. Then I went to *Kaila Dai'*[17]*s* home and gave him money.

During my school days, my teacher taught us simple interest. First, he introduced about principle amount, time in a year, rate in percentage, interest of principal amount and total amount. He told us that we needed to understand $I = \frac{PTR}{100}$ within 10 minutes. We prepared ourselves for his period within 10 minutes and after that he started to teach us about simple interest. He explained about interest very well that I got all the things from my mother. She taught me simple interest without any formula. My mother did that calculation without converting time into year and rate

---

[16] My mother

[17]Name of a person

into percentage. But our teacher taught us to change time into year and rate into percentage before putting it in to formula. He did not give us any examples from our daily life. According to him, I found sum of interest easy than the way my mother did. Still I am remembering about my compound interest class. I never found compound interest in my home activities because my mother always paid borrowed money within given time. Actually compound interest is that interest where we can add interest of interest. Runesson (2005) argues that there is no learning without something being learned. From my homely experience, I got the concept of simple interest easily but not compound interest. Parents can give their children to experience their own world through their own activity. And only from their own activity, they may develop true concept towards the subject matter. Thus to promote our students in their conceptual understanding, we need to focus our student in active learning process (Richard &Rebecca, 2003). Active parental activity can make students feel easier to understand the subject matter.

My Journey as a Novice Teacher

It could be around December in 2010, I got a job of a primary mathematics teacher in one of the private boarding schools in Kathmandu. During the first month of my teaching carrier, I felt very difficult to adjust with small students and also with my colleagues. In the very beginning of my classroom teaching, I was unable to understand my students' interests. English was the medium of instruction and I was from Nepali language background. My spoken English was not satisfactory in terms of teaching in English medium schools and the students did not understand my explanation easily. Because of my less speaking habit, my students were frustrated with me. One day, one of the students from class six said to me "Sir, we cannot understand your teaching". I made that word very much important word of my life.

After that, I started to think about myself and my teaching style. I was very much concerned about my language time and again. Before joining that school as a primary level mathematics teacher, I never spoke in English confidently. However, I appeared to have improved gradually with my hard endeavor and regular practice after some days of teaching. Then my students gradually started to enjoy my class and my teaching style.

Sometimes I would tell them to write reflection about mathematics, mathematics classroom and mathematics teacher. From those reflections, I generated some critical points for the improvement of my teaching and learn about my student's interests. After getting their reflections, I made plans to address their problem and started to teach them through activity-based teaching method. During the initial stage, it was difficult to think about activity in each and every class. But after some days of teaching, I started to feel easier than my traditional teaching styles. Persistent and continuous reflections within a practice of teaching are effective for teacher researcher and they help develop teachers' professional development also as research is linked with writing papers and making my 'findings' open for public discussion and critics (Krainer, 2006). After some classes, I started to write reflection on my teaching practice and it helped me to develop my teaching skill. My recent concept of researcher developed thereby helping me (hopefully) to become critical teacher researcher.

I have come to know that critical research critically examines the positivistic perspective of rationality, objectivity and truth. Critical social science promotes self-reflection which results in attitudinal change (Kincheloe, 2001; Skovsmose, 2006), and thus critical teacher researcher challenges the current educational system that puts emphasis on using students as numbers rather than persons. It helps to decrease

teacher-deskilling and helps teacher for emancipation and also helps develop reflective thinker. Self reflection and self questioning are the key terms of critical teacher researcher. My transformation began in teaching profession by applying activity-based teaching and becoming a critical user of it. Transformation is a "change" in mindset. It is based on learning a system of profound knowledge and taking actions based on leading with knowledge and courage. It is critical because assumptions and paradigms drive policies, procedures and most importantly, systems and structures. In teaching learning environment, teachers do reflective practice that is necessary for self reflection and self inquiry. So, teachers need to reflect on their practice, they need to think about their work, action, thinking, etc. If they are not reflective, then they may become ineffective teachers. Unreflective teachers tend to accept everyday reality, working only to find the means to carry out most effectively the ends demanded by their culture, which leads to further enslavement for it, leaves the person at the mercy of appetite, sense and circumstance (Cook, 1998). Transformation happens when people managing a system focus on creating a new future that has never existed before, and based on continual learning and a new mindset, take different actions than they would have taken in the past (Daszko & Sheinberg, 1998). Hopefully, I had my teaching transformed through activity-based teaching in my mathematics classroom. According to activity-based theory, knowledge is constructed as a result of personal experience of an activity (Leont'ev, 1981).

Chapter Summary

In this chapter, I have discussed about different influential factors of learning mathematics in my own socio-cultural and economic condition. In this chapter, factors are presented in different ways which are my parental beliefs, my surrounding

society, my teachers' image towards mathematics, context based mathematics teaching and novice teacher's reflection towards activity-based mathematics teaching. As I have discussed earlier the socio-cultural context of mathematics, I have represented my earlier beliefs towards mathematics and its impact upon conceptual mathematical learning. Thus, I am going to present narratives of my experience in a more comprehensive way in a sequential manner in the subsequent chapter.

CHAPTER III

JOURNEYING TRHOUGHMONEY AND MATHEMATICS: A LIFE FRACTAL IN EXPANSION (AND SHRINKING?)

Chapter Overview

This chapter portrays my mathematical achievement in different economic circumstances from my school mathematics to university mathematics as a mathematics student. In this chapter, I am trying to address how economical status influenced in my learning mathematics. In my contexts, mathematics is taken as a hard (difficult) subject and it is believed that mathematics requires more money and hard labor for the students according to the reference to my socio-cultural context and my own schooling. This chapter also depicts my two-dimensional experiences in mathematical interest and a mathematics student with poor economic background (in terms of low income, low living standards). This chapter shows my inner relation with mathematics and money. Money makes ways easy to go through, but my journey was complicated in terms of economy. If I try to remember my past journey, I felt very difficult to adjust with situation. It was a panic journey full of worries, difficulties, challenges and anxieties. Still I can remember my role as a bamboo seller, bird seller and many more. But that experience developed my speaking confident towards a mass as a businessman. As an initiator, I had done my role as a secretary in *Sahakari*[18]. That time I was a popular young boy with many friends and well wishers. They

[18]Local finance office managed by local people of village

(people of my society) believed in me for my every work and speech. But I was not seriously aware about it. So in this chapter, I am going to share my ups and downs of my journey of learning mathematics with reference to different economic status on the basis of following themes below;

- My socio-economic condition: A local economics of education
- Can home tuition increase students interest towards learning mathematics?
- Hiding with math teacher because of tuition fee
- Children with late beginning led behind
- Mathematics student as a wood cutter

My Socio-economic Condition: A Local Economics of Education

I was born in a reputed family of my society. At that time, each and every family member of my society was dependent on our family. Our family was so-called elite family in my village. There were more than 35 houses of different families in each *gaun*[19] and they belonged to different ethnic groups. Nobody of my community took any decision without my grandfather's advice. When I was in my Grade Three, our family started to live separately as a nuclear family. Before separation of my family from a joint family, there were many workers to do our works. But my father started to stop his involvement with family business and started to involve in social work gradually. He was popular person in our society. It was very difficult to say that our economic condition was going down and our reputation was going up because of my father's strategies. He always focused on our feeding and education only. Whenever I

[19] village

demanded any educational materials, I got them easily but not other things. We were continuing our study and other things as usual as the time passed by.

While I was studying in the Grade Five, my family faced one critical condition. It was my father's accidental death. I could not see smile over my mother's face for more than three years. Our regular income was blocked and we started to survive with poor economic condition. When we faced our father's untimely demise, my sister was doing intermediate in arts (I.A). Nearly for two years, we faced many difficulties to adjust in the society. After that, my sister started to earn money from job at one of the educational institutions. She started to conduct trainings on different vocational skills. In the mean time, our social members started to demoralize us (my family members) in different ways. They stopped hearing our voice in the society as before. Just helping mother and doing school work were my duties. During my primary education, I did not get any problem of money as I was a talented student. But after my primary school, I left my previous school and joined another school which was Shree *Parroha*[20] Secondary School, *Murgiya*[21] Rupandehi. My new school was 7 km far from my house. I would go to school by bicycle. I got new bicycle for the first time in my student life. I was excited and started to take advantage of my family support. That time I had habit of leaving class even during school hours. I started to lie with my mother and started to show teachers' absence for reducing my home work pressure. My poor economic status and learning both were going together. Same thing happened till I was in the 12th grade. After the completion of my 12th grade, I started to search for a teaching job for the support of my further study. I

---

[20] Name of the school where I studied upto 12th grade

[21] Name of place in my home district

applied for three schools, but I did not get. All of the school managers just gave words. Actually they wanted to use me for their business purpose without payment.

My two friends *Lila*[22] and *Kashi*[23] always gave me hope for future life. When I was searching for a job, they also tried to help me but did not get one. Both of them were teachers of a private school. Days were passing by and I was just thinking about my future and started to become non- academic person, or say, I started to do non-academic works. After some time, I thought 'going abroad can be the best way for my life' and started to talk with family members. All of my family members disagreed with me. They wanted to see me as an educated person. One day, I went to meet my brother-in-law to get permission for going abroad. He said to me, "It is not an appropriate time for you and you start your B. Ed (bachelor degree) at *Butwal Multiple Campus*. If you need any economic support, you ask and I can help you any time for your study". After that my hope of going abroad vanished right away and I started to think about my new life as a student. I started to learn for myself. My elder brother started to earn money and gave full support for my study. Because of him, I did my master's degree. Without his economic support, it was impossible for me to get admitted at Kathmandu University for study. After my B. Ed. second year to till now, I lived without any tension of money and got much confidence in learning mathematics. Now I can spend any cost for my study, I can buy any books if I feel it is necessary. So I am getting more knowledge confidently these days. But before some years, my economic condition was bad and my performance was also bad.

---

[22] Name of a person

[23] Name of a person

Can Home Tuition Increase Students Interest Towards Learning Mathematics?

When I was a child, I would get good marks in mathematics. I was interested in mathematics. I could compare doing mathematics with games. Every time, I would start homework from mathematics. My all surrounding society was from *Madhesi*[24] background. At that time, maximum *Madhesi*[25] students did not want to study up to the 8th grade, but our culture was different as maximum of us from my villagers wanted to study up to the 10th grade because of our parents' continuous counseling and support. Thus, the students from different villages would come to our village for home tuition class. That time, I always thought about tuition class and my belief was totally different. I thought tuition class could help to pass exam without doing much labor. I did not want to take any extra class until the sixth grade. But after sixth grade, my study was moving in decreasing order. I wanted to join

Adopting a "locked-in" thinking
Not a good way of learning mathematics.
Found different forms of mathematics
In terms of doing and thinking.

Writing about mathematics,
Could help find less errors
Than by thinking to overcome a terror
Of foreign mathematics.

Writing about mathematics
the best way of learning.
However a blind faith ruled
performing algorithmic problem solving

Writing about mathematics, however
Ended up reproducing others' texts ever
About the absence of creative efforts
Disillusioned about good progress reports

[24] One of the ethnic groups of Nepal

[25] Students from Madhesi community

tuition class for Grade Seven, but my mother was unable to send me there because of our poor economic condition.

I was crazy about home tuition even though my elder brother and sister were helping me for my study. While I was in the Grade Seven, my neighborhood friends were taking tuition class. I wanted to join but my mother did not send me. After that I started to cry and discuss with my mother, but I was unable to convince her.

Perhaps because of my negative attitude, I stopped learning mathematics and started to ask more pocket money for my daily expenditure. Actually, I was a lazy student for traditional mathematical assumption. Most of our teachers would say that writing again and again is the most appropriate ways of learning mathematics. But I was totally wrong at that time. After some time, I got my result on mathematics and realized that writing is also one of the most important parts of learning mathematics.

Actually I was too much excited to learn mathematics with my neighbor mathematics teacher. But because of our poor economic status, I did not get chance to improve my mathematical knowledge through tuition class. One day my sister told me that to learn mathematics with my elder brother but he was also feeling same problem because both of us were from same family, same culture and same economic status. So economy, I think, could play the most important role in my school mathematics.

My neighbor tuition teacher always assigned more class works for student. He strongly believed on writing way of learning mathematics. The students believed in home tuition but they did not know about how much practices they were doing in that class. They thought they were learning many things from teacher, but in reality, it was wrong assumption of those students who believed on tuition classes. If students engage in on more numerical activity, then they might achieve more in mathematics. Parents who engage in more numerical activities generally have children with greater mathematics knowledge (Blevins-Knabe & Musun-Miller,1996).

Similar incidents took place with my neighbor tuition teacher. I was too much upset with my family because of not providing me with a tuition class. There was no value of my voice while I was demanding extra mathematics class with my parents. My interest was mathematics, but our teacher always told us not to create disturbance in the name of discussion. He never tried to understand my problems. If I complained about his teaching, then he would tell me to go outside and join extra tuition class. The teacher never tried to think from our scenario. I was poor in mathematics and economy. But there was not any extra plan for the type of student like me. I think that a teacher needs to understand his/her student before starting his/her class. Understanding students as 'multiplicities' (Fleener, 2004) is important when we try to make sense of their differences in understandings, interests and performances. Once we recognize the multiplicity, we need to avoid reification. Thus, while we may recognize the multiplicities nature of our students, we should never assume we've "figured them out" or grasped the essence of whom they are, for the nexus of their being is continual renewal and reinvention (Fleener, 2004).

I think 'money' gives tension for many students all the time. Parental involvement in students learning activity is very much necessary for every student but parental involvement is not possible with poor economic background because parents need to go for their work. In my village, there was a culture of home tuition but it was affordable for only few parents. Some of my friends were very good in mathematics because they were getting tuition class continuously.

Hiding From Math Teacher Because of Tuition Fee

Once there was one mathematics student who was studying in the grade nine. In the Nepalese context, a student can choose two optional subjects in the ninth grade. I am talking about a student named Mr. *Bhattarai*[26]. For him, mathematics was chosen

[26]One of the cast of Nepalese

by other family members as an optional subject. In the starting days of mathematics class, Mr. *Bhattarai* was not interested in learning mathematics. Every time, he would struggle for pass marks only, but his mathematics teacher was quite different than other mathematics teachers. Actually mathematics teacher was knowledgeable person for that school. He knew every subject. Almost all the school teachers would ask difficult question to him. But mathematics teacher had a problem in terms of delivery of answers for the questions He could not perform very well compared to that of Mr. *Bhattarai's* class. Mr. *Bhattarai* would behave like restless people do. He did not like to write mathematics. He just wanted to speak in class room. He always solved mathematical problems with mental processing way because of his laziness. But his teacher wanted to see his writings in math. There were 24/25 questions in one exercise. But mathematics teacher would do only 4/5 questions from that exercise. The days were passing but Mr. *Bhattarai* became lazy and his mathematical performance was also going in decreasing order. His relation with mathematics teacher was also not good. He did not show his angry face with him. But he was totally dissatisfied with him. After some months, he started to think unnecessary things in math class because of his negative feelings towards the teacher.

Toyanath was planning to manage fee but unable to give it to his tuition teacher. He was quite different from his other friends. Immediately he got one idea to study mathematics without paying tuition fee. Instead of paying fee, Toyanath left the class and tried to hide himself from his tuition teacher. After that the teacher started to give information frequently to entire tuition students for money which compelled him to escape from the tuition class and mathematics teacher eventually.

Days were passing, but his negative attitude was developing towards optional mathematics. Attitude as a concept is concerned with an individual way of thinking, acting and behaving. It has very serious implications for the learner, the teacher, the

immediate social group with which the individual learner relates and the entire school system (Olatunde, 2009).

After some months, he got his first terminal examination result and saw only 32 marks in optional mathematics. After that, he started to think about alternative solution. He wanted to learn mathematics through less writing and more discussing method. But there was not any teacher who could teach mathematics according to his interest. He started to search for a mathematics teacher in local private schools and, fortunately, one day one young teacher agreed to teach optional mathematics for class nine. That new teacher was working in private school as a secondary teacher. He was Mr. Math sir. Mr. Math sir said to Mr. *Bhattarai* "I can teach you but you need to collect at least six students in a class and you should collect Rs400 from each student. After that, he asked his mother but she did not agree with him and told him to practice mathematics at home. He joined that class by force. His mother told him to leave that class because she did not have money to pay for extra class. Actually, he had to pay money for his extra optional mathematics class, but he did not pay fee. After one year, Home sir came to join his school and started to ask about tuition fee. He was afraid and started to feel shy in front of his school friends because Home sir shared all those previous things with his other class friends. Because of that event, Mr. *Bhattarai* did not feel comfortable in school later also. Once he tried to pay fee, but the teacher told him that it was not necessary. He excused him but information was already relayed with other friends.

This story shows how economic condition might affect mathematics student to learn mathematics in a proper way. Mr. *Bhattara*i took class, but he did not pay fee because of his poor economic background. After dehumanizing act of teachers' behavior, he couldn't feel comfortable in his school and his study was also affected.

Every student wants to reduce his economic problems from his study. If student suffers from this kind of problem, then he/she may not perform very well in study. That time he was memorizing, but he did not understand concept of mathematics in a clear way. When he was asked by the teacher, he did not know anything. Then, what else can he do?

Children With Late Beginning Lag Behind Inside The Class?

When I had completed my fifth grade, I was supposed to join another school because my previous school was just up to primary school. We were not able to manage money for new admission on time. Later, I joined Shree Parroha Secondary School, *Murgia*[27], Rupandehi. In that new school, I was in section *Gha*[28] (D) and my roll number was 68. According to the admission, I was the second last student of that class Six. Thus I did not get my sitting place on the first and the second row. I always sat on the second last bench since I joined late. That time my poor economic condition compelled me to sit on the second last bench. Our class was crowded because there were 69 students in the Sixth grade, section *Gha* (D). There were many sections in each class and many students in each section. It was very difficult to see and hear teacher's activity and voice from the second last bench. My interest towards classroom activity was going down because I started to feel less

> *I don't know how I became mathematics student even my interest was not on mathematics. Just I was doing mathematics for formality but not for my future. I didn't know about any concept of mathematics but I was able to find solutions without knowing its use in my daily life. For only one subject mathematics, I felt it as unnecessary subject because of my miss conception about it. That time I would ask; what is mathematics? where is it? why are people doing this useless mathematics?*

[27] Name of place in my own district

[28] 4th Nepali alphabet

attachment with my subject teachers. Time was passing day by day and I was enjoying with new environment because I started to feel freedom from subject teachers' assigned work. Sometimes I submitted my homework and escaped sometimes. It was very much interesting life of my school. Actually, I was poor in economy, and thus, I did not get pocket money from my mother regularly. I started to play carom board and earned some money for my personal expense. There was one sport shop in front of my new school and its business was to collect money from carom board which we would play. The owner of the shop would collect Rs[29] 4 per game. We would play game with 10 Rs per game agreement. If I lose game, then I had to pay 4 Rs for shopkeeper and Rs 10 for opposite winning partner. That time I collected some money from game. My mind was totally concerned with money. Slowly, my achievement was going in decreasing order and my interest seemed to be vanished gradually to. I started to buy wallet in cheap price and sell in high rate. Buying and selling wallets was my another work that I did during my school days. Those things appeared to be related to my study. Slowly those things seemed to be my influential factors of learning mathematics. At the very beginning of my new school, I started late for my study and for a whole year I stayed ‘behind the class, behind the classroom performance, and behind the teacher’ (refers to downfall in terms of study). As a result, I got less mark in mathematics. I did not show my mark sheet to my sister and brother because I had achieved less marks and was just a ‘pass’ student. Until my study in class five, I got the first position at school. But after one year, I became a poor student in mathematics because my concentration was diverted towards earning money rather than learning mathematical concepts and knowledge.

---

[29] Rupees, Nepali currency

Mathematics as Money Making Subject

I can still remember those days when our country was in critical situation. It was around 2003 and I was a college[30] student then. My major subject was mathematics, but I was just taking classes provided by college and I was not paying attention to it at home. Most of my friends were earning money, but I was a so-called fulltime student and I did not have money-making job. My elder brother was staying in India without any communication and my younger brother was studying in a school. We (my family) were in an economic crisis. We did not have any extra income sources except my mother's pension. Each time I was suffering because of lack of money. I could not invest full concentration towards my study. I was merely doing my study for social value. There was not any extra intension towards social belief. Merely spending 4 hours at college was my duty.

Actually, I wanted to join the Management Stream, but I joined Arts Stream majoring in Mathematics and Economics because of social and economic values of those subjects. Each time people were talking about mathematics teacher and English teacher. In my community, mathematics and English teachers were earning much money by taking extra tuition classes compared to other subject teachers. When I completed the SLC exam, I was the second student and the first student was studying major English and mathematics both because of social status of those subjects. But after his intermediate level of study, he also left one subject because of his misconception about money making subject. These days, I think, mathematics

---

[30] In Nepal, Higher Secondary level of education is called college education. Although not an official nomenclature, this reflects the historical model of education after matriculation.

teaching concept is going largely and it is not like traditional mathematics teaching concept as it would-be earlier.

But how I become (or claim to become) constructivist teacher is the important question for my teaching career. Constructivism is a philosophy of learning founded on a premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own ‘’rules’’ and ‘’ mental models’’ which we use to make sense of our experiences. Learning therefore, is simply the process of adjusting our mental models to accommodate new experiences (Star, 2005).Constructivists are talking about knowledge construction process and they don’t believe on knowledge transmission process (Star, 2005). I got a number of mathematical ideas through knowledge transmission process. So, I could not perform according to its concept. When I was in the B. Ed. level of my study, I thought that I would get practical way of learning mathematics so that I could make more money through it. But the situation was different. All the teachers would teach from traditional way of teaching. I could not get psychological support from my teachers. All of them came from tradition beliefs of teaching mathematics. My plans were going to fail and thus, I started to think mathematics in a different way than my teachers did. I started to compare mathematical concepts with my personal situation and beliefs.

After the completion of my SLC, I became a private tuition teacher for school mathematics. I was teaching for grade nine and ten students. My teaching was accepted by them and I was a popular young teacher for those students. Then after, the community started to give a space for my voice. And the elder people of my society also believed that I was the young mathematics teacher who could teach mathematics practically. But the situation was different. I mean I was teaching them

from traditional way of teaching. I never cared about student's interest. I just focused on their exam paper format and taught accordingly. After some year, I came to know that learning is the process whereby knowledge is created through the transformation of experience. I never tried to relate mathematical problems with my own context while I was teaching them. Without conceptual teaching learning process, I started to make more money through my tuition class. I was feeling happy because I was the student of mathematics till that time. I started to fulfill my personal desire through money which I got from mathematics class. From morning to evening time, I was busy with students who were living in my village. That time my destination was to make money through mathematics tuition class. After some time, I began to reflect my practice and started to think. My reflections are presented below:

I forgot to remember myself.

I forgot to think about my next direction.

I forgot to think about mathematics.

I forgot to respect other people who were from another subject background.

I forgot to practice mathematics.

I started to convert my desire into money.

I started to respect myself for being a mathematics student and developed myself as a narcissist.

I started to become a mathematics student with negative attitude and hypocritical intelligence.

But the situation was quite different than I would think. I should set my desire according to my socio-economic context. I started to show my proud behavior with other social members and finally I became a *mathematics learner who had no desire to learn, who had no desire to teach student and the one who had no destination in*

life except money. Finally, I earned money but I could not get good conceptual mathematics learning. So, I cannot forget those days because past days made me money-oriented but not knowledge-oriented. So now, I can say that those days pushed me some year behind the running year.

Mathematics Student as a Woodcutter

Once at *Kha- Bangai* VDC in Rupandehi, there was a student of mathematics education who was doing his B.Ed. He was a money seeker rather than a knowledge seeker. He always would think about money making process through any work. In the morning time, he would go to the Campus and after coming back from campus, he would spend his time with brokers. All of his broker friends were earning good amount of money, but he was always in trouble. One day, wood cutting tender notice was publicly announced by local forest consumer committee. He got that information from one local political leader and started to talk to all committee members. Some of them agreed to give him and some of them did not. There were nine members in the committee and he started to make majority for his side. After one week negotiation, he made maximum members on his side and he got tender. He hired some woodcutter from India and started to cut all the woods from the local forest. But before cutting, he paid amount in advance for forest consumer committee. It was around Rs 50,000. In the morning time, he needed to go campus and in the afternoon time he would do that sort of additional money generating works. The woodcutters were cutting and he was sending it to brick chimney factory. After two days, some political agents (political cadre during the insurgency period in Nepal) leaders came

and told him to stop it and return all the woods that he sold. He told them that the consumer committee was responsible for that, because without their permission, he could not cut. But the leaders started to show their power and threaten him. That time, our country was in transition period and nobody felt secure in their own society. Our government was absent for general people. Unidentified groups were leading our society. So, he felt unsecure as he was threatened continuously. But he was innocent and ignorant about all those political actions. He decided to give extra money for them, but nobody took his money and demanded to return all sold woods. He was in trouble. Only few people wanted to help him. He was supposed to get punishment from local political leaders. After few days, he decided to involve in politics for his security. He joined the next party and started to make power for his security. It took whole one year to settle. Every week, he went for meeting for the settlement of that case. Politicians continuously accused him of cutting woods illegally without any tender and without their prior permission. His 'final exam' was also coming at hand but he couldn't perform very well because of the social torture.

This story portrays my experience as a *political* person, as a mathematics student and as a general person with low economic status. Actually, his story starts from his economic background portraying how forcefully he happened to join politics for his own security. There were no any options left for him. That situation affected his learning mathematics. Every time he spent his invaluable time for about a year for good settlement of his problem, but he could not. So, this factor could also be one of the most influential factors of learning mathematics.

Mathematics, Money and Child Psychology

When I was child, I always played a number of mathematical games without knowing mathematics in a formal way. I would count, subtract and divide without knowing any

rules. Sometimes, my neighbor brother asked me to count from one to hundred for one rupee. For one rupee coin, I would do whatever he asked. During my childhood age, my father sometimes would say to me, 'If you finish your home work today, then I will give you five rupees'. Still I remember those activities done by myself for money. When I was in the fourth grade, I was the first student of my class and we were five close friends. My grandfather always would come to see me during break time for my breakfast at my school. He did not give me money for breakfast, but he would buy some food items for me. In the meantime, I wanted to spend money according to my interest as I just wanted money. Getting more money was my concentration. I was thinking about money and its sources and started to search source of money time and again.

My two close friends were from rich family background, but they did not want to learn mathematics. Mathematics homework made them irritated and frustrated at times. They just wanted to complete their homework. One day, I proposed them to give me some money for completing their homework. I started to do their mathematics homework for two rupees. I did their work many times, but our mathematics teacher did not find the gap between his assumption and my friends practice. He was happy to see their work continuously, but my friends were just submitting their homework done by me. One day, one of my friends' parents came to visit my mathematics teacher and said that he was satisfied with his son's mathematical achievement. When I heard that word, I started to laugh and my friend's father said to me, 'Why are you laughing?' I said to him, 'I am just laughing for his drastic change in mathematics and I hope one day he will win me'. Again he said to me, 'My son will definitely win you'. It was like fun. I think my friend's father was supposed to believe in his economic power, but the situation was just opposite. That

time I was getting money and mathematical practice. Because of money, I became crazy to do mathematics homework time and again. Before doing their homework, I would practice those problems provided by our subject teacher. Actually, children are innocent and they can do anything if they feel it is necessary for them. At that time, my goal of doing mathematics is to obtain the right answer (Sam, 1999) and make money. Because my recent belief of mathematics learning was almost wrong, I came to know about other learning conceptions also after some years. Perhaps my interest towards money, and my psychology made me strong in primary mathematics content. It was just like rote memorization and not more than that. But when I came to Kathmandu for my master's study, I never felt any crisis of money and I started to learn mathematics and tried to connect some mathematical concepts with my socio-cultural settings. With unflinching support and counseling from my revered tutor, Dr. Luitel, I thought myself as an academician which, I assume, might have gradually helped me to wipe out my obsession towards earning money. By and by, I developed my positive attitude towards teaching and learning of conceptual/contextual mathematics.

Chapter Summary

In this chapter, I have presented and discussed some of my classroom events and my socio- economic condition consequently. The entire subtopics show that economic factor could be one of the important factors of my learning mathematics. Different conditions made me to do different works for survival. I had done many works within my study period and those works influenced my conceptual learning mathematics. I spent the most of my time for making money rather than learning mathematics. So, I think that economy could be one of the major influential factors of my learning mathematics. I learned some social behaviors for adjustment within my

society. My parents' poor economical background made me more social and developed my extra skills too. Everywhere I would connect mathematics with my own context and my mathematics made me strong in my society. Sometimes I used mathematics for making prestige; sometimes for power and sometimes for money. Defiantly, those events might have affected my conceptual mathematical learning because I was busy in other works rather than mathematics. Thus I could not make a connection of mathematics with my daily life and I could not make an image of mathematics in my daily life.

CHAPTER IV

JOURNEYING THROUGH CULTURALLY DECONTEXTUALISED AND CONTEXTUALIZED MATHEMATICS EDUCATION: A LIFE FRACTAL IN TRANSITION

Chapter Overview

In previous chapter, I have presented some influential (hindering and empowering) factors which might have affected my conceptual mathematics learning process. This chapter portrays my mathematical learning experience as a mathematics student and as a novice teacher. Here, I am going to present different scenarios in the form of my narrative showing transitions from traditional mathematics classroom experience to constructivist activity-based teaching learning process in mathematics class because the nature of mathematics is also an influential facet for teachers and students. Sometimes, we may feel difficult to understand the teaching learning process because of various perceptions. Our own perception about mathematics and our teachers' perceptions about mathematics may be responsible for making our teaching learning process more empowering and meaningful. This chapter discusses possible relationships between our mathematical learning context and learning achievements under the following theme;

- Teacher’s image and student’s belief in mathematics classroom
- Mathematics irritates sometimes
- Plane figure and surface of lake
- Learning trigonometry without meaningful concepts

- Why teachers teach in an opposite way
- Mathematics as a fun subject Different views of mathematical knowledge and its impact on teaching learning process

Story-1: Teacher's Image and Student's Belief in Mathematics Classroom

Until the Fourth Grade, I was a creative and curious student. I started to show my creative activities from the fourth grade. I had been involved in sports, quiz, poem writing, debate, singing, dancing, drawing and essay writing activities etc. I didn't know about any other social relations. I knew only one thing- that was my academic result. I started to cry as I got to know about the low marks I got in that examination and I left school on that day. That day I was very much serious because I never got least marks on mathematics. Before that examination, I always would obtain full mark on mathematics. The next day my principal called me and I met him at his office. First, he tried to convince me for my number, but I said to him, 'I don't like my math teacher'. All of sudden, he started to beat me and scolded me a lot. Then I left his office and directly went towards my class, entered in to the classroom when my mathematics teacher was teaching. He asked what had happened to me and I promptly replied that I did not like his teaching methodology in the class. I even blamed his for my less marks in half yearly exam. He consoled me not to be disheartened with the marks I got being an intelligent student in the class. Rather he inspired and encouraged me for the development of

The mark given in mark sheet was only one reflection of my mathematical understanding. High marks represented good and low represented bad. Nobody tried to check concept from practical way. I did not know about conceptual learning of mathematics. I thought I was the good mathematics student because all of my teachers were talking about my mark only. All of them were concerned with mark obtained in mathematics. I was a so-called good student in mathematics even I did not know about its meaning in my real life. Solving problems and finding right answers were my mathematics as a whole.

algorithmic problem solving skill. His continuous correction, inspiration and encouragement helped me to increase my problem solving skill. He would scold and beat me even for my small mistakes whereas he would give me problems for solving in front of class on the blackboard. From such a continuous pressure, I was able to be a good mathematics student. Does this really mean that I was a good student? What do I mean by a good student?

Interestingly, my teacher used only those examples which were given in the text book. In mathematics class, algebra was my area of interest in which I liked simplification very much. My teacher was very good algorithmic problem solver. He would describe mathematics step by step. I started to link previous mathematical steps with next and tried to get answer easily. Without knowing its implication, I learned many more things in mathematics. I saw three-dimensional geometry in my real life which corresponds to the views that 'students' beliefs about their learning contexts refer to beliefs about the role and the functioning of the students in their own class, beliefs about the role and the functioning of their parents, and the sociological view about mathematics' (Jin et al. 2010). Thus, my learning context made me good algorithmic problem solver without knowing its concept.

Story-2: Mathematics Irritates Sometimes

It can be any day in the month of August 1998, the first period bell rang. All the students were entering the classroom. Toyanath was also one of the students of class seven. Some of his friends saw him quite nervous. He was quite aggressive and he did not want to talk to other friends and started to draw something without

informing his bench partners. *Durga, Bimal, Kiran and Bishnu*[31] were his bench partners. Meanwhile, his friends started to talk about him.

Durga: Hello Bimal! Why is *Toyanath* silent today?

Bimal: I don't know about his silence actually, but he is drawing something now.

Kiran: Bimal, you should know about his silence because you are closer than me with him and he would inform you everything before us.

Bimal: Yes, he would inform me. But he has not informed me about anything today.

Durga: Bimal, ask him about the problem which he is facing.

Bimal: Hello, Toyanath! Hello, *Toyanath*!

Toyanath does not reply.

Bimal: Toyanath, what has happened to you? Why are you ignoring us? Please speak to us.

Toyanath: Nothing *Bimal*. I am not ignoring you all, but I am not feeling comfortable with mathematics class today because our teacher taught about algebraic expression yesterday and gave us more home works as well. But I was unable to do that and I know he is going to beat me because he told us that he would punish for every single mistake. I have not been able to finish fifteen questions. So, I am going to get fifteen sticks punishment for not being able to accomplish fifteen questions.

Bimal: Oh! I have also not solved any of the questions assigned. Ask with other three friends whether they have done mathematics assignments or not.

All three replied no.

Kiran: Don't worry. We will copy from Toyanath because he has done his homework.

---

[31] Name of person

At the same time, Toyanath completes his drawing and put it into mathematics book.

Toyanath: Kiran, I tried so many times but did not get idea about it. I asked with my brother, but he was also unable to solve. So what to do? Do you have any idea?

All four discussed on mathematics homework and found one beautiful solution that was- all of them got determined to leave mathematics class. That time, Nepali teacher was teaching and they were discussing by writing on piece of paper and passing it to the teacher.

(*Tring.... tring....*) The second period bell rang. It was mathematics period. All of them gave their books and notebooks to other friends and went to hide themselves at the back side of school building. After 10 minutes, the teacher came to teach mathematics and he found most of the students absent in the class. He asked with class monitor. The boy monitor said, 'Sir, I do not know but girl monitor informed to sir that they were present in first period'. The teacher wanted to know as the teachers are the single most important resource for developing students' mathematical identities (Anthony & Walshaw, 2009).

My Mathematics Teacher

My mathematics teacher is like a ghost
Or like a villain in Hindi movies
Who always plays negative roles
With lots of foul plays with tainted souls

Mathematics class- a complete boredom
Where the learners enjoy no freedom
Facts, figures, signs, symbols and solutions
Enough for fear, tensions and frustrations

No care about the learners' interest and hobbies
Solving the problems his responsibilities
Following his teacher- a shameful heritage
What's the use of this meaningless mathematics?

The teacher started to check home work afterwards. Some of the students got punishment as they were not able to solve the algebraic problems. One of the brilliant students of the class said, 'Sir, we did not understand your yesterday's teaching. That’s why we were unable to solve'. Then the teacher called him and thrashed two sticks on his back. He started crying, but nobody responded. Actually, our mathematics teacher tried to show himself as the supreme person in the classroom. He always wanted us to understand his way of teaching the very first time which was very difficult for us as he only gave us lot of assignments after solving two or three problems. But he never tried to contextualize algebra, geometry and arithmetic to our real life situations.

After assigning us few questions for class work, he went to search those five students who were absent in the class. He found them hiding at the backside of school building. He wanted to know the reasons regarding why they bunked the mathematics class. Nobody gave response due to fear. One of them started crying all of sudden. Then the teacher took them out in front of the school and started to beat them badly. Seeing this, Toyanath became too much aggressive with mathematics teacher. Toyanath said, 'I did not understand your teaching and I was unable to do your homework. That’s why I did not complete your homework. Your teaching made me mad. So I do not want to take mathematics classes’. The teacher started to beat him too. Toyanath started crying. The teacher asked Toyanath to bring his mathematics book and notebook. Toyanath did accordingly. Then the teacher opened his book and found one picture drawn by Toyanath. There was one picture and the picture represented mathematics teacher's image. He saw his image in that drawing. The picture represented many things like long moustache, aggressive face, black and heavy man with one stick.

The student made teacher's bad image because of his hatred towards teacher's traditional way of teaching. There are two kinds of mathematics classroom contexts. One is traditional mathematics classroom context and the other is the new classroom context. The characteristic of the traditional mathematics classroom context is that the teachers play the main role in teaching activities. The characteristic of the new classroom context is that the students are the center of the classroom, and teachers occupy the leading position (Jin et al, 2010). Our classroom was totally teacher-centered. We never got change to do mathematics in front of the class. We had to copy what the teacher wrote on the blackboard and nothing more than that. The teacher's beliefs about teaching mathematics are directly involved with student learning process. Maximum students in early stage think that their teacher is always right and their given solution is the final solution of every mathematical problem. The beliefs about mathematics learning refer to the views about students‟ ability and the methods of learning" (Ernest, 1991). Thus, the teacher needs to make them strong in their mathematical beliefs.

Story-3: Plain Figure and Surface of Lake

When I was in my Bachelor first year, our teacher came to teach us differential calculus and the topic of that day was tangent and normal. He started his teaching with his interesting past events that were related to our topic, Tangent and Normal. At first, he introduced all the pre-requisite things like Arc, Normal line. Tangent, Circle, Derivative, forms of the question of tangent and normal and their derivatives. He told

us that a single derivative always gives us slope. He always believed that writing practice in mathematics is very much important. He always told us to solve same problem more than ten times before exam. But he did not give us any examples from our daily life activities. Suddenly, I remembered one thing about Arc length and tried to relate it with our society. When I was a child, I always tried to observe the plain surface of a pond which idea evoked in my mind regarding its relation with arc length. Then I started to discuss with my mathematics teacher. We had huge discussion, communication many times. Since the teacher was from Madheshi ethnicity, he would talk to me in a bilingual language (both in Madheshi and Nepali). Here, I would like to present one communication dialogue between me and my calculus teacher:

Teacher: Toyanath! What are you thinking in this class?

I: Oh! Nothing sir.

Teacher: Where are you now?

I: Sir, I am in the classroom and I am paying attention to your teaching.

Teacher: No, I don't think you are paying attention to this class now.

I: Sir, I am trying to relate this topic with our daily life.

(Then he started to give one example for me)

Teacher: Ok Toyanath, where are you living?

I: Sir, I live in Murgia (place near to Butwal city).

Teacher: How many kilometer you travelled for this class today?

I: 14 kilometers.

Teacher: Which way did you follow for this class today?

I: Sir, I followed Mahendra Highway.

Teacher: How many sub ways are connected with Mahendra Highway from Murgia to campus?

I: Sir, I don’t know.

Teacher: There are many sub ways connected with Mahendra Highway, but you followed straight Mahendra highway because your today's destination is Butwal Multiple campus. If you had gone through any other subways, you would not have been here or you would have been late. So every student needs to concern about their destination only. You don’t need to think any extra things within this class. Your destination is to gain knowledge of solving the equation of tangent and normal. Thus, you think about this only and whatever I do, teach and tell you to do in this class

I: Sir, I am not thinking about any extra unnecessary thing. I am just thinking about the surface of a pond. Sir, can I ask one question?

Teacher: Yes, please

I: What type of surface does a pond have?

Teacher: Very simple question. It has a plan surface.

I: No, I don’t think it has a plan surface.

Teacher: Then?

I: It has a curve surface because our earth is round. Everything is centered because of gravity. We see small arc because of which we are feeling it like a plane surface

Teacher: It’s nonsense. (The teacher shows his angry face in front of class and all the students start to laugh hearing my argument). Then the teacher says, ‘Ok then, it is your duty to do research. Carry on!’

I feel surprised, nervous in front of classroom and remain silent.

After this conversation, I started to discuss with my class mates. They told me that I was wrong with my argument. They also told as the teacher that the surface of a pond is plain. This made to ponder upon it seriously and I started to ask the same question with other teachers also. I did not get any satisfactory answer from other

teacher also. After some years, I came to join University of Annapurna for my master's degree. One day, one of the professors from University of Annapurna came to teach us mathematics education, and I remembered the same question and asked him inadvertently. He gave an answer that I expected since all long years. He told me that it is a curve surface, and because of small arc length we see it as a plain figure. Until my Bachelor level of study, I developed misconception of mathematics as my teachers forced me to learn mathematics through rote memorization method. They did not agree with conceptual learning. They never thought about students' interest towards conceptual learning. That time I was searching about mathematics within my surrounding environment, but rarely found mathematics in our society. Mathematics teachers should teach them how to perceive the beauty in mathematics, cultivate in them the abilities of solving social problems about mathematics, and guide them to understand the relationships of mathematical concepts (Jin et. al., 2010). Sometimes, the teacher needs to respect their students. But my teachers showed me their aggressive face because of my so-called funny and idiosyncratic question. However, I was able to relate mathematics with my socio-cultural practice. If the students see their teachers face happy, then only they can feel comfortable with teachers.

Story-4: Learning Trigonometry Without Meanings

Once in Rupandehi district of Nepal, there was a mathematics student who studying in grade Ten of Parroha Higher Secondary School. He would do lots of mathematics problems for trigonometric identities in his ninth grade. But he did not know about the actual concepts of *sineα*, *cosineα* and *tanα*. His teacher

taught him lots of problem solving methods and he found solutions also, but he was unknown about the meaning of ratios. Every time, his teacher told him to memorize formulas as he was teaching about application of those formulas for solving mathematical problems. But the students never got chance to think about the application of trigonometric formulas in their real life situations. However, that boy was habitual with doing trigonometric problems and finding solutions. One day his teacher came to teach about the formula of

tan(A + B), *tan*(A - B), *sin*(A + B), *sin*(A - B), *cose*(A + B) and *cose*(A - B). The teacher told him to write:

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A.\tan B},$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A.\tan B},$$

$$\mathrm{Sin}(A + B) = \mathrm{SinACosB} + \mathrm{CosASinB}$$

$$\mathrm{Sin}(A - B) = \mathrm{SinACosB} - \mathrm{CosASinB}$$

$$\mathrm{Cose}(A + B) = \mathrm{CosACosB} - \mathrm{SinASinB}$$

$$\text{and } \mathrm{Cos}(A - B) = \mathrm{SinASinB} + \mathrm{CosACosB}$$

Then all the students started to memorize it. After two days, the teacher solved some problems by using above formulas, but he (the same student) was confused about ratios. He did not know what is *sinA*? What is *cosA* and what is *tanA*. He was thinking about algebraic equations and started to think why tan(A + B) = tanA + tanB is wrong because he was using x(y + z) = xy + xz . He was puzzled and tried to solve some problems, but every time distracted because he did not know about trigonometric ratios values and their meaning. While doing his mathematics, he was facing unnecessary problems because of his teacher's way of teaching. Finding solution was only the aim of doing trigonometric problems. After that, he started to

ask his friends but they were also unknown about it. They knew only the way of finding solutions. Nobody convinced him. He couldn't see trigonometry in his real life. At the same time, his teacher told that those sorts of questions were important for exam. He was going to fail in the exam. One day he wanted to meet his neighbor. He was also studying in another private school. He was able to convince him. His friend Shankar made him clear about the scenario. He taught about ratios first and used these formulas

$$Sin\,\theta = \frac{perpendicular}{hypotenuse} = \frac{p}{h} \qquad Co\sec\theta = \frac{hypotenuse}{perpendicular} = \frac{h}{p}$$

$$Cos\,\theta = \frac{base}{hypotenuse} = \frac{b}{h} \qquad Sec\,\theta = \frac{hypotenuse}{base} = \frac{h}{b}$$

$$Tan\,\theta = \frac{perpendicular}{base} = \frac{p}{b} \qquad Cot\,\theta = \frac{base}{perpendicular} = \frac{b}{p}$$

Where, Ɵ represents the angle. Similarly in SinA, CosA and tanA, A represents the angles. He gave lots of information about ratios and their nature. Only after his friends teaching, he came to know about trigonometry. After that, he stopped comparing his habit with algebraic equations. Before teaching any mathematical concepts, the teacher should give a basic knowledge necessary for that mathematical concept. Every time the teacher needs to think about the level of understanding of their students. Before starting any chapter or exercise, the teachers need to think about the question, how do children learn (Star, 2005)? My experience says that every student tries to link his/her past mathematical knowledge with new mathematical concept. So, before giving any new mathematical concept, the

teacher needs to make student clear about the new and old chapters' concepts. According to Dewey (1963), it is the teacher's task to create learning environment which interacts with the existing capacities and needs of those taught to create a worthwhile experience (p.45). This interaction of learner's existing capacities with the appropriately structures challenges of the learning environment enables the learner to develop new knowledge. The teacher should, therefore, make a connection between the students' old concept and new knowledge. Mathematical learning should be viewed both as a process of active individual construction and process of enculturation into the mathematical practices of wider society (Cobb, 1994). As in aforementioned story, the student tried to relate trigonometry with algebra. He was actually right in terms of algebra, but the concept was different in trigonometry. The teacher did not make a connection between both trigonometry and algebra. Every time teacher needs to make their student clear before solving the mathematical problems. In this regard, Cruickshank (1999) states:

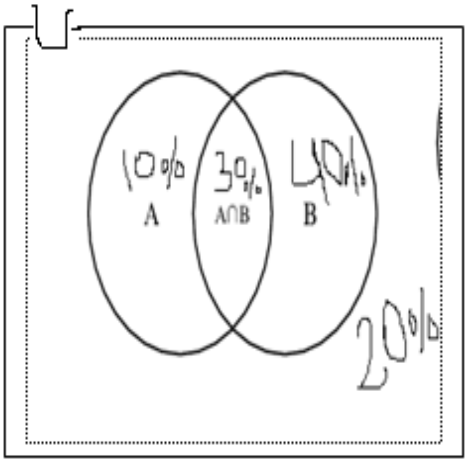
> A set of factor influencing how you will teach are your schooling experiences. Those experiences include the way you were taught, your preferred ways of learning, your preferred ways of teaching, your proficiency in your chosen teaching or academic field, and the kind and amount of teaching preparation you are receiving. (p. 6)

There may be many factors influencing to making teaching strategies for mathematics teachers. But the teacher may try to maintain their problems before entering the classroom. My teacher always looked like a confident teacher and he did mathematics confidently, but I couldn't understand him because of his one way of teaching. Ayer (1993) states that "Teaching is more than transmitting skills; it is a living act, and involves preference and value, obligation and choice, trust and care,

commitment and justification." (p. 20), but I did not find it during my schooling. My teachers rarely used teaching materials except chalk, duster and black-board (Pandey, 2010). The activities like writing and listening were our duties as a meaningless ritual.

Story- 5: Why Teachers Teach In an Opposite Way

It could be any day of March in 1999, my teacher came to teach Set in class nine. I was learning about set from class six. I already knew about some concepts. First of all, he reviewed some previous exercises from Set and started to do some problems related to complement of set. Still I can remember that day when our teacher was teaching about cardinal number of sets. While learning other things of sets, I was enjoying with his teaching. But he did it using different way on that day. His answer was not wrong. I was feeling uncomfortable with him because of opposite way of teaching. He posed one question and that was; There were 300 students in a school. Set A is students who liked to play football and Set B is students who liked to play basketball. n(A) = 40%, n(B)= 70% and n(A∩B)= 30% find $n(A \cup B)' = ?$



In that question, the cardinal number information was given in percentage and we had to find the cardinal number of the complement set of A U B that means the student who did not want to play basketball and football both. In that question, he found the percentage of the students who wanted to play football only after that the percentage of student who wanted to play basketball also. He found 10% and 40% respectively. He added all percentage of students who wanted to play football only, who wanted to play basketball only and who wanted to play both. He found 10% +

40% + 30% = 80% respectively. After that 80% was subtracted from 100% and found 20% for student who did not like to play any game.

In the second step, my teacher found 20% of 300 and wrote $n(A \cup B)' = 60$. I was thinking about the contextual meaning of cardinal number, but my teacher was searching about the shortcut way of solving problem. I thought he should find 40% of 300, 70% of 300 and 30% of 300 at first and add all numbers. After that he should subtract from 300 because there were total 300 students. I hope the aim of question was to make us clear about cardinal number, but our teacher was only concerned with shortcut way of finding solution.

This story shows about teacher's approach of teaching Set in classroom, but the teacher did not try to address his student's feeling towards his teaching. Cardinality is about counting and percentage is about scaling. He used percentage only but did not emphasize on cardinal numbers. If the students did not understand his teaching, then they would feel his writing as mere symbols only. Looking at unnecessary symbols will not make a sense of understanding even though mathematics teaching symbols are also important if they give some specific meaning as the symbols are would make convention-based distinctions so as to facilitate communication (Niss, 2006). Thus, this story does not show teachers' positive belief towards teaching mathematics. Most of mathematics teachers in Nepal are not using appropriate teaching concept in mathematics classroom. School mathematics is a kind of training (or in Bishop's term: playing) situation and it will always have its own culture. The contents of school mathematics reflect a certain stage of the historical development of mathematics but will not see great changes in the future (Schweiger, 2006). Till now, the history of Nepal shows that there are only few teachers who are trying to address their students' feelings. In Nepalese village, the less qualified

teachers (teachers with less academic qualification) are teaching mathematics. They don't know about the proper way of teaching. They are unable to give proper practical classes for their students. A theoretical explanation is worth nothing if it is as complex as the phenomena to be explained. I mean my school teachers did not teach mathematics with my cultural relations. But it will give only mere shadows of phenomena if it is too mathematical and formal. Between these two horns of the dilemma, mathematics and mathematical education have oscillated during a long period of time in history (Otte, 2006). Most of our school mathematics teachers are taking mathematics as an objective subject, for whatever they say becomes object-like. They think that there is only one solution of algorithmic problems. They are guided by their own traditional way and notion of teaching mathematics since their significant years of teaching experience.

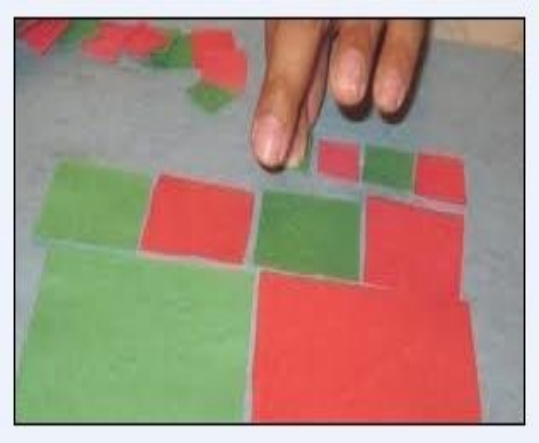
According to my experience as a student and teacher, there is not a single way of solving mathematical algorithmic problems. The teachers can apply different ways of finding solutions of many mathematical problems. They should see the world by their own subjective perspective on doing and learning mathematics, explicitly surpassing and extending a traditional cognitive view (Maier, 2006). Mathematics teachers need to contextualize every mathematical problem according to their lived realities. They should give different ways of problem solving skills according to their student's context. But the above story shows totally opposite of that. Thus, we need to think about our ground reality before entering the classroom. My teacher always tried to transmit knowledge rather than constructed new knowledge (new meaning of phenomenon). According to Ayers (1993), "Teaching is more than transmitting skills; it is a living act, and involves preference and value, obligation and choice, trust and care, commitment and justification." (p. 20), but I could not find a similar case in my

teacher's teaching methodology he adopted. Because of those reasons, I was getting frustration by learning mathematics and my school mathematical performance was also getting low.

Story-6: Mathematics As A Fun-Filled Subject

When I was in B Ed second year, there was one subject which was strategies for teaching mathematics. My best teacher (Teacher of mathematics education) was teaching that subject at Butwal Multiple campus. I never felt pressure and difficulty in his class as he was quite different from other lecturers. He was not teaching in a formal way totally. He always would give relevant examples from our daily activities and our surrounding environment from which we learned many things necessary for mathematics classroom. According to Vygotsky, the teacher's role is to lead the learner to higher levels of thinking by interpreting and giving significance to things and event. His teaching was somehow similar to Vygotsky's approach. He always tried to contextualize mathematics with our own lived realities. If the students see mathematics in their own society or in culture, then they can feel it as their own subject and they can make their positive attitude towards mathematics. I think culturally contextualization of mathematics (Luitel, 2003) is necessary for everywhere so that every mathematics student can feel easy for learning mathematics. That time, my teacher (Teacher of mathematics education)would contextualize algorithmic problems with my socio-cultural world since the teachers as socio-cultural critics are responsible for making the culture, worldview, social arrangements and everyday practices of their society more accessible to their students (Mason, 2000).

I learned mathematics in different ways in that class. I learned by using paper folding mathematics practical exercise, by using solid materials, by drawing pictures and sometimes by using chalk and talk method. That was really an interesting class for me. That's why I still can remember those days as 'good days' for my learning journey. He never talked about extra work but we wanted to do. Because of his friendly behavior, we took him as our favorite teacher who would always support, encourage and use interesting ways with contextualization while teaching mathematics. Every time, I and my friends started to ask him because we wanted to learn something in more practical way. I made geo board, circle board, many more polyhedrons, tan gram and many things with his help. After that, he started to teach me about their uses in classroom. He gave many ideas for classroom management also. Actually, he was behaving like friends do. In this regard, Prabhakaram (1998) says;



> There is no difference of opinion on the need for Teaching of Mathematics as a part of general education. Our society is moving into a technological era. We need people with sound mathematical skills. The present state of teaching mathematics in the majority of our schools is far from satisfactory. (p. 1)

Though it was not a 'pure mathematics' class, he was giving us the knowledge about the connection between pure mathematics and other subjects. Pure mathematics and applied mathematics are both rooted in the same culture (Paudel, 2008). From that class, I came to understand the importance of students' interests. Without

respecting students' interest, we may not teach them. Culturally relevant teachers utilize students' culture as a vehicle for learning (Ladson-Billing, 1995). Our teacher (mathematics education teacher) would teach us according to our interest and always tried to connect with our daily life. That time textbooks were widely used in classrooms as the source of mathematical learning (Olkun & Toluk, 1998), but he never followed only one text book. He used many more sources of content. He was just concerned with curriculum but not just with textbook whereas other teachers were teaching single textbook. Lax (1999), in this regard, states:

> Good teachers, at any level, rarely follow a textbook faithfully, even if they have authored it. In selecting a text, then modifying it, we use our mathematical knowledge as well as our classroom experience. By listening to the students and reading their assignments, we become aware of what students find difficult and why; we note where misconceptions and anxieties are formed; our mathematical knowledge together with our curriculum agenda combine to lead students into meaningful mathematics. (p. 87)

If teachers do not give any pressure to the students, they can do many more things for their personal and professional career. I think my mathematics education teacher was always searching about alternative solutions for every mathematical problem. He believed on knowledge construction process rather than on knowledge transmission process. According to Vygotsky, we can regard him a constructivist teacher who always would say that Mathematical objects are created by human (Hersh, 1997, p. 41). which is why mathematics is our ‘own’ subject. But can we be able to own this? He would say that if the students feel comfortable with their subject teacher, then they can achieve more. It so happened to me. Finally, I achieved more

and I enjoyed lot with that subject and teacher because of my teacher's perception towards teaching.

Views About Teaching Learning Process

The teachers' perception about the nature of mathematics also may affect the students' conceptual learning. There may be different types of views about mathematical knowledge. But according to Ernest (1991), there are different types of teachers' views about mathematics. They are absolutist view of mathematical knowledge, the fallibilist view of mathematical knowledge. The different views of the teachers and the students also affect the learning process. I learned something from mathematics from absolutist view of mathematics. So I do not have clear concepts about some mathematical knowledge.

Ernest (1991) states that, the absolutist view of mathematical knowledge is that it consists of certain and unchallengeable truths. According to this view, mathematical knowledge is made up of absolute truths, and represents the unique realm of certain knowledge, apart from logic and statements true by virtue of the meanings of terms, such as 'all bachelors are unmarried'(p.7). My school teachers rarely tried to search different alternatives. The presumption of the absolutist view is that mathematics is fundamentally free from error (Ernest, 1991). That means the solutions is fixed and single, but the new concept is different. Some believe in logicism, intuitionism and some in constructivism. Logicism is the school of thought that regards pure mathematics as a part of logic (Ernest, 1991). Earnest further states that logicism is the school of thought that regards pure mathematics as a part of logic and all the concepts of mathematics can ultimately be reduced to logical concepts (p.8). They believed on objective reality. Mathematical objects can have well-determined properties because mathematical problems can have well-determined

answers (Hersh, 1997). He further states, ‘A world of ideas exists, created by human beings, existing in their shared consciousness. These ideas have objective properties, in the same sense that material objects have objective properties. The construction of proof and counterexample is the method of discovering the properties of these ideas. This branch of knowledge is called mathematics (p.44).

But fallibalist believed that mathematics is fallible and there is not any fix rigid solution or way of solving any mathematical problems. Intuitionism represents the most fully formulated constructivist philosophy of mathematics (Ernest, 1991, p.12). The world we live in’ can be understood also as the world of our experience, the world as we see, hear and feel it. This world does not consist of ‘objective facts’ or ‘things-in-themselves’, but of such invariants and constancies as we are able to compute on the basis of our individual experiences. To adopt this reading, however, is tantamount to adopting a radically different scenario for the activity of knowing. From an explorer who is condemned to seek ‘structural properties’ of an inaccessible reality, the experiencing organism now turns into a builder of cognitive structures intended to solve such problems as the organism perceives or conceives. Fifty years ago, Piaget characterized this scenario as one could wish ‘Intelligence organizes the world by organizing itself’ (Piaget, 1937). What determines the value of the conceptual structures is their experimental adequacy, their goodness of fit with experience, their viability as means for the solving of problems, among which is, of course, the never-ending problem of consistent organization that we call understanding.

> The world we live in, from the vantage point of this new perspective, is always and necessarily the world as we conceptualize it. ‘Facts’, as Vico saw long ago, are made by us and our way of experiencing, rather

> than given by an independently existing objective world. But that does not mean that we can make them as we like. They are viable facts as long as they do not clash with experience, as long as they remain tenable in the sense that they continue to do what we expect them to do. (Glasersfeld, 1983, p. 50–51).

Constructivists believe on knowledge construction process. According to Ernest (1991), the constructivist program is one of reconstructing mathematical knowledge (and reforming mathematical practice from the perspective of different actors) in order to safeguard it from loss of meaning, and from contradiction. To this end, constructivists reject non-constructive arguments such as Cantor's proof that the Real numbers are uncountable (how interesting that would be if we were to bring some constructive dimensions to our school mathematics education). He further states, constructivists claim that both mathematical truths and the existence of mathematical objects must be established by constructive methods. This means that mathematical constructions are needed to establish truth or existence, as opposed to methods relying on proof by contradiction. For constructivists, knowledge must be established through constructive proofs, based on restricted constructivist logic, and the meanings of mathematical terms/objects consist of the formal procedures by which they are constructed. (p.11). But I learned mathematics from traditional way of teaching and learning context because of which I still feel somehow like a traditional mathematics learner due to my own culture and habit. Learning and doing mathematics in a traditional way became my culture. We would discuss on social constructivism and radical constructivism, but I am still not practicing more mathematics according to constructivist approach. Social constructivism links subjective and objective knowledge in a cycle in which each contributes to the

renewal of the other. In this cycle, the path followed by new mathematical knowledge is from subjective knowledge (the personal creation of an individual), via publication to objective knowledge (by inter subjective scrutiny, reformulation and acceptance). Objective knowledge is internalized and reconstructed by individuals, during the learning of mathematics, to become the individuals' subjective knowledge. Using this knowledge, individuals create and publish new mathematical knowledge thereby completing the cycle. Thus, subjective and objective knowledge of mathematics each contributes to the creation and re-creation of the other (Ernest, 1991, p.43). Sometimes individual's subjective knowledge also can become objective knowledge when an individual's subjective mathematical knowledge production enters the public domain through publication. When our local mathematics (number system of different ethnic groups, communal problem solving), which is deemed to be subjective, becomes objective?

The teachers need to make their classroom meaningful, but because of their views about mathematical knowledge they are practicing from their own traditional way of teaching and the students are also learning mathematics in the same traditional way. Many Nepalese mathematics students still believe on the traditional way of learning. The students from school to university are following traditional way of mathematics learning strictly. Thus, this teacher's view about mathematics is also one of the influential factors of conceptual mathematical learning.

Chapter Summary

This chapter shows that teacher's view is also the most important for student's conceptual learning achievement. If the teachers can teach mathematics with their contextual activities and examples, then the student can pay their attention for mathematics learning, they can learn it for life long, and never feel mathematics

anxiety. The teachers who believe on textbook teaching cannot teach their student well in an interesting and motivational way. It’s very difficult to maintain students' discipline and to draw their attention in study. The teachers' concern will be concentrated on how to handle the situation and offer effective mathematics education to the students (Pandey, 2010). The teacher as a critical mediator of knowledge (Mason, 2000) must know about their student's interest, nature of mathematics, socio-cultural barriers, mathematical content and its connections with social beings. Contextualization of mathematics is a process of adapting the concept of mathematics in relation to the social and cultural values of place where the learners live (Luitel & Taylor, 2007). If the teacher can connect the things with real world, then mathematics will be easier for the learners as mathematics is particularly active discipline (Talbert, 2000). Active learner only can learn mathematics easily or other may feel it difficult subject. The views about mathematical knowledge are also very much important for developing concept-based teaching and learning of mathematics. But our teachers are textbook-oriented and most of the teachers are not even using national curriculum of Nepal while teaching mathematics. Thus, this nature of mathematical knowledge, old classroom structure, chalk and talk method of teaching, teachers having less content knowledge and giving more homework without conceptualizing the mathematical content are some of the influential factors which directly or indirectly affect the process of learning mathematics.

CHAPTER V

JOURNEYING FOR/TRHOUGHTRANSFORMATIVE MATHEMATICS EDUCATION: A LIFE FRACTAL IN RECONSTRUCTION

Chapter Overview

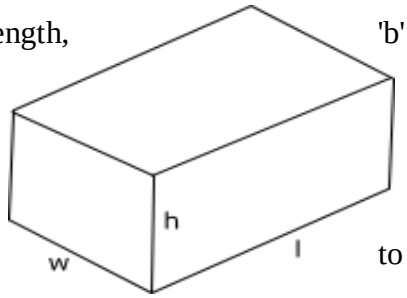
This chapter represents some of my life evidences from classroom experience, my learning process through traditional classroom to possibly constructivist classroom regarding how my teachers dealt with mathematical problems in my classroom. My learning process was quite different than my friends because I was curious about most of the problems presented by our teachers, and how my teachers created sharing environment within my mathematics classroom. It also shows the relations between *foreign* (Luitel, 2003) mathematics and our own mathematical practices. My imaginative thinking was related to my own mathematical world and I was concerned with how traditional teachers did mathematics with reference to Nepalese culture. In this chapter I try to find some feasible answers of the questions like, how I transformed my thinking and learning mathematical practice. Why did I develop my negative attitude towards learning mathematics? How can I contextualize the mathematical concepts in my socio cultural situation?

This chapter also presents some learning practices which may help to transform learners' traditional thinking to new way of thinking to some extent. It may refer some transformative ideas for making mathematics contextual. It also tries to show the teachers' role in making mathematics contextual. I have discussed about contextual mathematics under the following theme;

- Height of solid
- Time calculation through household works
- Text book as my whole mathematics
- Algebra and my practice
- Learning fraction through rote memorization
- Facing some de-contextualized questions in my school mathematics
- Arousal of Interest towards mathematics learning through Local learning materials

Height of Solids

I would like to remember one event on volume of cubes and cuboids. One day our teacher came to teach us volume of cuboids and volume of cubes. Actually, my teacher taught me that volume of cube is always $V = l \times l \times l = l^3$, cube unit and volume of cuboid is $V = l \times b \times h$ cube unit, where 'l' refers length, 'b' refers breadth and 'h' refers height of cube or cuboid. That time I was confused find the length, breadth and height of cuboid. I asked that question



to my mathematics teacher and he answered that length is always longer than breadth and height. Then again, I felt very difficult to understand. I asked another question to him. '*Sir, my height is 4ft now. If I sleep then, what will be my height?'* I was surprised with my conceptual question. But my mathematics teacher did not give answer. He tried to show but it was like puzzle game. He turned cuboid differently and I got different length of same cuboid. I was surprised to see different height, length and breadth of the same cuboid.

That time I was unknown about vertical height and it was very difficult to understand the height. I turned cuboid and I found different height, length and breadth. I realized that every child in a primary school was facing the same problem. Thus the curriculum designers need to ponder upon it seriously before designing content of the curriculum and its organization. Horizontally it might be good, but vertically there was a problem to develop the knowledge about height. It is very difficult to understand the height of anything conceptually without understanding 90^0 angles. I was not aware of angles. So I couldn't get clear concept of vertical height. According to my experience, it would be better to introduce after teaching angles so that students can understand vertical height easily. The real life problem may help to construct their understanding for meaningful learning outcomes (Poudel, 2010). It could be better to introduce any terms with their real life settings so that students can feel comfortable in learning mathematics. Teachers of my school were trying to decontextualize our own mathematics.

Time Calculation through Household Works

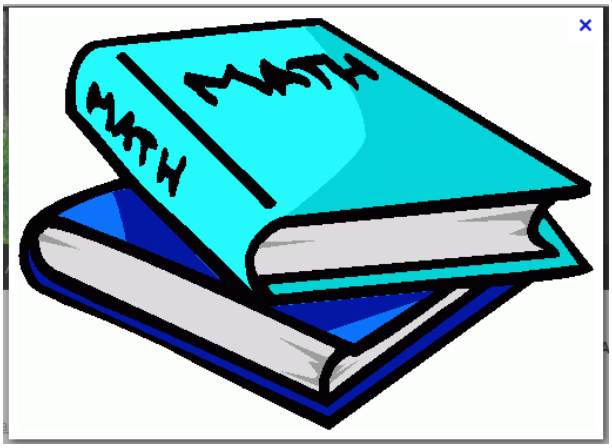
When I was a child, we (my family) had some land and our another major profession was farming. I was grown up in *Terai* region of western part of Nepal. A tractor was the main instrument to yoke in the field. All of my family members would engage in farming. My mother would send me to see the tractor ploughing, sometimes to see and check whether the workers were working in the field, and sometimes to bring water for workers, to buy goods for our workers. That time we were using tractor for threshing straw. My mother would ask me about the time taken by tractor for our farm work every time. At the very beginning, I was weak in subtraction of time. Thus, I always would add from starting time to till end time of work done by tractor. The mathematical questions like, subtract 4 hour 20 minute from 5 hour

4minute was difficult for me, but I could find the answer through addition. In such types of question, I always would start from 4 hour 20 minute to till 5 hour 4 minute through addition. I was always concerned with more minutes needed for making 4 hour 20 minute to 5 hour 4 minute to solve the problem and find the answer.

But my teacher's approach was different. He always would do the subtraction the way we would do generally. Taking barrow and changing it into another unit was very difficult for me. But I understood time calculation from my own context. Regarding such mathematical problem, the children can bring a lot of local issues of application of mathematics from their household practices to classroom that can help girls to understand the value of learning mathematics and also it makes learning mathematics a fun (UNESCO, 2008). So every child is getting mathematical knowledge from his or her everyday life in one or the other. If I remember my childhood days, I had done some mathematical problems without any formal schooling knowledge. Similarly while taking care of animal; it is important to feed them nourishing food that contains green grass, thatch of rice and wheat, maize powder and remains of vegetables. It can be a context of teaching set, fractions, ratio and proportion, percent, measurement and so on. There is direct relationship of nutrition in the food and milk they give (UNESCO, 2008). From each and every daily life activities, teachers can make mathematics contextualized. I was doing lots of household works, but I never tried to relate it with mathematics. My aforementioned story substantially argues that the students might feel comfortable with doing mathematics if he or she sees it before taking any formal class. Nevertheless, very few of my teachers tried in any way to contextualise mathematics in their class as expressed by Luitel (2007).

Text Book As My 'Whole Mathematics'

Still I can remember those days when I learned mathematics as a *foreign* language (Luitel, 2003). My teachers were teaching mathematics through text books only. The text books were their main sources of mathematical knowledge. I was feeling comfortable while completing whole mathematics textbooks practice. I had a strong belief about textbook as a whole mathematics. There was no more mathematics except mathematics text book. I rarely tried to see mathematics in my daily life while I was studying in school level. I thought that the given problems in text book were only the mathematical problems. My teachers also believed in text books. They would do work out examples which were given in textbooks. In our school mathematics textbook, there were some topics which were prescribed by our national curriculum. Some authors wrote textbooks which were not suitable for our socio-cultural background. Some writers would copy mathematical problems from Indian authors' textbook. Till now, most of the Nepalese schools are applying Indian based textbooks and those authors who are claiming their textbooks are written in Nepalese context are merely doing commercial business only. They are trying to fulfill the national curriculum putting some mathematical contents only. They take mathematics as a discrete task. They copy, paste and put some contents especially from foreign mathematics curriculum in Nepalese textbook and curriculum.



It's my very personal view. But still I can say that there are only few people who are capable for textbook writing who can address the county's situation. People seem to think about their commercial business and the government is unable to implement policies in such stage. Luitel (2009) states that, “The exclusive image of curriculum as subject matter and discrete tasks and concepts coupled with transmissionist pedagogy play a vital role in reproducing such a culture." (p. 263). So our curriculum focused on subject matter oriented education. That’s why textbook was taken as a whole mathematics. Luitel (2009) also has put a question about the organization of curriculum as, "Why do you take the risk of preparing the same readymade meal for the entire population of teachers and students? Why do you not give same ingredients and invite them to create a multitude of meals, instead?" (p. 284). There were many people who were working in curriculum making process, but nobody took any initiatives for changes beyond the Tylerian model because of which I was suffering from our traditional view of organization of curriculum.

I spent my childhood with traditional concept of curriculum and mathematics. Those who were able to hire textbook from India gave so-called modern education, but the condition was worse. Mostly, nobody tried to include new pedagogies for meaningful mathematics teaching and learning process. Sidhu (as cited in Pandey, 2010) writes that;

> meaningful learning in mathematics consists of the mathematical experiences which are helpful in mental, emotional and social development; which are useful in learning higher and advanced aspects of the subject; which are helpful in the proper learning of other subjects and activities of the curriculum; which have utilitarian, practical and behavioral values; which are stimulate and maintain

> interest in the subject; which lead to the development of proper attitude towards the subject (p. 139).

While I was a school student, I rarely found culturally relevant mathematics pedagogy in my mathematics classroom. Culturally relevant mathematics pedagogy may make mathematics classroom meaningful which builds on the thinking, experiences and traditions of our student (Tate, 1995). The purpose of culturally relevant pedagogy is to empower students to critique society and seek changes based on their reflective analysis (Ladson- Billings, 1992. p.26). Everywhere we can see mathematics. It consists in each and every cultural society. In everyday life, people experience mathematics activities knowingly and unknowingly (Poudel, 2010). Poudel further states that people of our society are using many mathematical concepts carefully and successfully without actually being aware of the formula or any formal definition (Poudel, 2010). So mathematics may be everywhere, but every people may not see the world of mathematics every time.

Mathematics is everywhere but I could not see it. Every time my teachers were stuffing me the ‘textbook mathematics’. I was unable to make a connection between mathematics and my real world (surrounding society). My aim was to complete assigned homework from textbook context only. Theoretically, improving children problem solving skills is an important aim of mathematics education (Olkun & Toluk, 1998). But the practice was different. The very textbook-oriented learning killed my creative posture towards mathematics. I always thought that teachers' voice was the supreme for each and every class, but it might be my wrong assumption about the teacher.

Algebra and My Practice

In the initial days of my schooling, I was very much interested in practicing Algebra. Solving the algebraic problems and finding their solutions were my fun games. Similarly, writing and finding practice activities were also familiar to me. I was thinking about its application in solving the problems not to our daily life purpose because my teacher taught me Algebra for writing and solving the algorithmic problems only. The mathematics teachers of my school helped me develop the way of solving problems mathematically only. My lower secondary mathematics teacher never presented contextual examples from my socio-cultural situation. One day my teacher came to teach Algebra in Grade Eight. He was teaching about the formula of $(a + b)^2$and $(a – b)^2$ with its uses in problem solving. He told us to write $(a + b)^2 = a^2 + 2ab + b^2$ and $(a – b)^2 = a^2-2ab + b^2$. I started to rote that and I got it easily. There was one trick to remember both formulas. I compared the pattern and develop my own way for remembrance. In the middle of 'a' and 'b', if there is (+) sign then before with 2ab also (+) sign and if there is (–) sign then before with 2ab also (-) sign. I tried to remember both the formulas instead of learning its application in my real life.

My Algebra

Practicing on note book
Thinking about the steps
Remembering the answer
Was my journey of learning Algebra

How could I seek for its application in my daily life;
Whence my teacher rarely realized its application in our real life;
My teacher unable to give its meaning of real life;
My devotion to mathematics teacher and the application of Algebra
Bore no meaning in my student life.

Algorithmic problems were my factual
Rote memorization became my ritual
Contextual mathematics, my necessity
In the midst of learning diversity.

Next day, the teacher came to teach us its application in the ‘mathematical world’. He started to solve problems with the help of formulas, but I did not get its

meaning. I was thinking that mathematics is just invented for writing purpose and we cannot see Algebra in our life. I was convinced with my teacher and did many more factorization problems related to Algebra by using those two formulas. He used those formulas for some questions. The teacher wrote on the blackboard about factorization of $x^2 + 8xy + 16y^2$ and $a^2 – 10ab + 25b^2$. For the solution of the first and the second question, I tried to solve as below:

My solution: 1^{st} .x^2+ $8xy + 16y^2$

$= x^2 + xy (4 + 4) + 16 y^2$

$= x^2 + 4xy + 4xy + 16y^2$

$= x (x + 4y) + 4y (x + 4y)$

$= (x + 4y) (x + 4y)$

Therefore, $x^2 + 8xy + 16y^2 = (x + 4y) (x + 4y)$

My solution 2^{nd}: $a^2 – 10ab + 25b^2$

$= a^2 – 5ab – 5ab + 25b^2$

$= a (a-5b) –b (a- 5b)$

$= (a- 5b) (a- 5b)$

Therefore, $a^2 – 10ab + 25b^2 = (a- 5b) (a- 5b)$

Teacher's solution 1^{st} : $x^2 + 8xy + 16y^2$

$= : x^2 + 2.x.4y + (4y)^2$ comparing this equation with $(a + b)^2 = a^2 + 2ab + b^2$

$= (x + 4y)^2$

$= (x + 4y) (x + 4y)$

Therefore, $x^2 + 8xy + 16y^2 = (x + 4y) (x + 4y)$

Teacher's solution 2^{st}: $a^2 – 10ab + 25b^2$

$= a^2 –2.a.5b + (5b)^2$, comparing this equation with $(a – b)^2 = a^2 + 2ab + b^2$

$= (a – 5b)^2$

$= (a - 5b)(a - 5b)$

Therefore, $a^2 - 10ab + 25b^2 = (a - 5b)(a - 5b)$

Both the solutions are the same, but the processes are different. However, the processes are different but not contextual. The teacher promoted (un/knowingly) de-contextualized mathematics. The teacher could at least think about its meaningful learning activities. Just writing on the notebook and learning through rote memory may not give sense of mathematical solutions. Can these types of solutions make sense to you? Can our children pay attention for these types of learning? Can these types of solutions represent our daily lifeworks? These are the major questions which strikes me time and again.

Learning Fraction Through Rote Memorization

It could be any day in 1996, I heard about unlike fractions. My teacher taught me that if denominators are different or not equal, then that type of fraction is unlike fraction. I was confused in finding denominator and numerator from given fraction. My teacher gave us trick for finding the denominator. He told me the word denominator starts from the alphabet ‘d’ and the word 'down' is also starts from the alphabet ‘d’, so the 'down one' is always the denominator. He made a connection between the two words and made me clear about finding the denominator. After that, I did not face any problems regarding the denominator and numerator.

It was the day for the addition of unlike fraction. The mathematics teacher came to teach us addition. His teaching was numerically fine, but he did not help us develop concept. As a learner, I developed many more ideas for solving fractional problems. I was facing fraction everyday in my home, school, street, and many more places, but I could not see it except on my mathematics notebook and mathematics text book. My teacher would write on the blackboard and I would copy his writing. It

was my learning process. Now I have come to know about fraction little more. As a teacher, I am showing fraction to my students from their everyday life. But as a learner, I did not develop ideas so that I could contextualize it with my everyday life. My teacher simply would copy problems from the text book and solve the problems on black board. Even for the addition of unlike fraction, he would teach us by taking LCM. My previous practice was unpractical. The process given below shows my traditional way of learning:

Fractional problem: Find the addition of $\frac{2}{3}$ and $\frac{3}{4}$

$$\frac{2}{3}+\frac{3}{4}$$

$$=\frac{2*4+3*3}{12}$$

$$=\frac{8+9}{12}$$

$$=\frac{17}{12}$$

Taking lowest common multiple is also very hard for lower class students. As well as using that concept on the fractional problem or simplification is another challenge for small kids.

This process seems like little complicated for primary student. The student who is in primary level might not perform this complicated process accordingly. This scenario presents somewhat a clear picture of decontextualized mathematics teaching learning process. In this learning process, the teacher focuses on procedural knowledge but it seems like decontextualized mathematics because I have not seen any practical examples on it.

My New Direction Guided By Real Analysis

While I was studying in B. Ed. second year, there were some prescribed subjects (e.g. Foundation of Education, Mathematics Education, Modern Mathematics etc.) which were directly or indirectly contributing to the making of me as a teacher. At the very beginning of our class, I remained absent for a number of days and later

felt Real Analysis harder than the other subjects because our tutor taught basic things at first. In the University class, I was not satisfied with my tutor. All of my friends were taking Real Analysis as a 'hard' subject. One day, one of my friends told me that maximum students failed in analysis. It made me little bit scary about the subject. However, I developed the concept about Set which I had learned in Modern Mathematics. While learning modern mathematical concepts, I was preparing for its solution. I wanted to publish a TU solution (solution of all old questions which were asked in TU end-of-the-year exam) of Modern Mathematics. I spent much time for developing the cookbook-like 'solution'. While preparing this, I discussed with many mathematics teachers. I was passionate about doing it. Modern Mathematics was taught in B. Ed first year. Could there be a postmodern mathematics? In my TU solution of modern mathematics, I introduced some concepts about some mathematical chapters. After finishing it, I heard that TU was, unfortunately, going to launch new programs for B. Ed. and Modern Mathematics was, therefore, no more a subject to be taught at B .Ed. level.

Actually I was not interested to join the B. Ed. level of study. I wanted to go abroad, but I was unable to go because of my economical condition. I was thinking about possible alternatives, but I did not get permission for another work. Then I was compelled to join B. Ed. At the very beginning of my B. Ed. class, I was an irregular student. I did

Real Analysis and My Practice

Learning Real Analysis of mathematics was my passion. Doing mathematics and playing with analytical mathematics were my games.

Making pictorial representation of different theorems was my hobby. Making alternative proofs was my challenge

.

Consulting with teachers and presenting my views with friends was my works. Mathematical understandings and connecting with new ideas were my focus.

Focusing on procedural knowledge of different theorems was my process.

not want to take class. We (I and my friends) spent more time without taking class. My campus was 20 km far from my house. I would travel 6 km by bicycle and 14 km by bus every day. While I was at B. Ed. level of study, I was feeling tired because of long distance. I was not getting enough money. So I was unable to spend money for breakfast. Mostly I would spend Rs10 for breakfast. My campus time was from 6 am to 11:30 am. It almost took one and half hour to reach home. It was very difficult to satisfy my hunger with two *Pakodas*[32] from morning to till 1 pm noon. I would reach home at one o' clock and take a lunch. After lunch, I would complete sleep for an hour as a regular routine. And at the evening time, I would help my mother to milk and feed the cow. We had one cow which gave 12 liters milk every day. The management of feeding and medicine for the cow was my responsibility. Thus I was engaging with my mother's work also. At the same time, I was engaging indifferent social works (e.g. cultural programs, construction work for social development). It was very busy time for me and managing time for study was my major challenge. In my B. Ed. study, I never took curriculum and other soft subjects seriously. I simply wanted to learn Real Analysis and other mathematics related subjects.

Slowly I started to make a note on theorems and started to develop some concepts on it. After few months, I was able to develop some concepts on Real Analysis of mathematics. Nearly half of the year, I spent on making notes and developing concepts which my teachers were presenting in our analysis classroom. My teacher would come with note and always would copy notes on the black board. We (my friends and me) were frustrated with his teaching. We were taking his class for making notes only. Only for few chapters, he presented some ideas to help us

---

[32] A type of snack prepared for breakfast.

develop concept. It seemed like a self-study model. Sometimes he would say, "*It will not come in your exam, so leave it now for some proofs of theorems*". Every time my friends were talking about his irritating teaching style. He was a permanent lecturer at a University. So we could not do anything to him for his teaching style and strategy. One day, we went to complain about his teaching to the head of the department. He told us he would do something for us, but nothing happened after all. After that, we started to discuss with friends for mathematical concepts. Slowly, I became good concept-giver of analytical mathematics. At that time, Riemann Integral carried 27% weight in final exam but it was very easy task for me. From the group discussion, my friends started to believe my ideas and they would consult with me on Real Analysis mathematics and I was also feeling comfortable with explaining my ideas. That time my teacher would say, "*Whatever I teach, learn that much only and it's not time for concepts development, it's time for exam preparation*". His approach was making us exam-oriented and we were following the suit.

One day in the year 2006, some of my classmates proposed that I would teach a tuition class for Real Analysis. I told them to give me two days for confirmation. After two days, I told them that I would need 600 Rupees per month from each student if they really wanted me to take tuition class. They agreed and then I started to teach them Real Analysis. However, my teaching was totally exam-oriented otherwise they wouldn't pay me? But the teaching made me clearer on content knowledge. My knowledge of Modern Mathematics made me more comfortable for teaching Real Analysis. For that I would like to give my sincere thanks to Modern Mathematics teacher, who inspired me for being an active learner. Perhaps active learning is a necessary step for contextualizing mathematics in learners' contexts. His suggestions always guided me towards learning direction. I taught some chapters only because of

time bound. I taught nearly for about two months. After that, all of us started to prepare for exam. Actually, I was not a good student according to University's assessment system. I was unable to rote-memorize more theorems within a short time frame. But when I saw content on the book, I explained it very well in front of my friends. After a few months, our result was published and I did not see my symbol number on the board. I did not feel uncomfortable to it because I was sick when I was taking my curriculum instruction and evaluation subject's exam. I was unable to write properly and I was even unable to sit properly. My 'student friends' (my own class mates whom I taught tuition class) were surprised with my result and one of my student friends asked me about my papers which I had taken in exam. I told him about my condition. They were supposed to get good marks in Real Analysis and finally the two student friends only got more marks than me in Real Analysis. I told them the number I obtained, but they did not believe me. Why should they?

Teaching mathematics to my friends was very interesting moment in my life. I was feeling comfortable with them because it was not a formal class and all the students whom I taught were familiar to me. They knew everything about me and even my socio economical condition. So my experience says that knowing students and teachers deeply may play positive roles in learning mathematics. Actually I did not contextualize real analysis with my socio cultural settings, but teaching decontextualized mathematics also made me a conscious mathematics learner. It helped me to learn mathematics. After that, I started to feel comfortable with mathematics learning. To speak the truth, I actually joined mathematics education forcefully, but I started to feel proud of being a mathematics student. That time, my brother-in-law and my brothers played positive role for directional changing stage.

And I was studying mathematics for my parents' sake. By then I started to learn mathematics for myself.

Facing Some *Decontextualised* Questions in My School Mathematics

While I was in Grade Ten, I was just thinking about *Trigonometry* time and again. My teacher would explain us about the proper use of trigonometric formulas and the way of finding solutions. I had never seen the usage of proof of trigonometric identities in my daily life activities. I had seen without alternatives for some questions. Those questions developed my anxiety in practicing mathematics where I could not use my creativity. That time I was feeling that mathematics was not my subject because there were not any alternative solutions which I had seen in my own life activities. Here I am going to present example which present strong example of decontextualized mathematics.

1. $(2\cos\theta + 1) (2\cos\theta - 1) (2\cos 2\theta - 1) (2\cos 4\theta - 1) = (2\cos 8\theta + 1)$

Sol^{n}:

R.H.S

$= 2\cos 8\theta + 1$

$= 2\cos 2 \times 4\theta + 1$

$= 2 (2\cos^2 4\theta - 1) + 1$

$= 4\cos^2 4\theta - 2 + 1$

$= (2\cos 4\theta)^2 - 1^2$

$= (2\cos 4\theta - 1) (2\cos 4\theta + 1)$

$= (2\cos 4\theta - 1) (2\cos 2.2\theta + 1)$

$= (2\cos 4\theta - 1) \{2(2\cos^2 2\theta - 1) + 1\}$

$= (2\cos 4\theta - 1) \{4\cos^2 2\theta - 2 + 1 \}$

$= (2\cos 4\theta - 1) \{(2\cos 2\theta)^2 - 1^2 \}$

A Mere Puzzling Mathematics

A tourist presenting signs and symbols
On the canvas of big blackboard
Often turning back with scary eyes
A pin drop silence all around

Other hopeless creatures busy copying
No single chance for understanding
Being the mere artists of imitating
Among the crowd was I satisfying
With the foreign mathematics

I grew up with curiosity
But victimized with the anxiety
Always sought for illumination
But encountered with confusion
With foreign mathematics

$= (2\cos 4\theta - 1) (2\cos 2\theta - 1) (2\cos 2\theta + 1)$

$= (2\cos 4\theta - 1) (2\cos 2\theta - 1) \{2(2\cos^2\theta - 1) + 1 \}$

$= (2\cos 4\theta - 1) (2\cos 2\theta - 1) \{ 4\cos^2\theta - 2 + 1 \}$

$= (2\cos 4\theta - 1) (2\cos 2\theta - 1) \{(2\cos\theta)^2 - 1^2 \}$

$= (2\cos 4\theta - 1) (2\cos 2\theta - 1) (2\cos\theta - 1) (2\cos\theta + 1)$

$= (2\cos\theta + 1) (2\cos\theta - 1) (2\cos 2\theta - 1) (2\cos 4\theta - 1)$

L.H.S = R.H.S.

Hence, proved.

Does the above example not show that mathematics was totally decontextualized in my situation? My teacher never tried to connect *Trigonometry* with our own context. Knowing the procedural knowledge and writing on the notebook were my learning strategies for school trigonometry mathematics. Procedural knowledge emphasizes on students' algorithmic problem solving ways by writing. I was studying aforementioned type of mathematics for exam purpose. It did not make any sense for my learning of mathematical concepts in a real sense. The aforementioned questions and their solutions were not generating conceptual meaning for trigonometric identities. Giving solutions or proofs were my whole trigonometric concepts. At that time, I was suffering from some questions. I was searching those questions and their answers within my heart. Those questions were like; Can this mathematics make any sense? Where do they exist? Why teachers are writing solutions or proofs? Can this type of knowledge change my mathematical world? Why did my teacher not give any examples? How do those formulas and solutions work in an individual's life?

Mathematics was taken as a difficult subject in our context because of our teaching and learning practice. My teacher was satisfied with the way I was able to

solve the mathematics problems in no time. But at the same time, I was not feeling well because of my teacher's teaching style.

Arousal of Interest Towards Mathematics Learning Through Local Learning Materials

When I was a child of about five years old, I played different games with my friends. I was using solid materials for games as a child usually likes to play with solid materials. I was unaware of mathematics but I was playing with my mathematical world. In my context, there was *Madhesi* (those who were originally from India and had been living in Terai region of Nepal) community and they had their own way of living. It seemed different than mine. I saw Geometry on their hand many times. My house was nearby the *Tinau river* (the river at Butwal, Nepal). There was one special *Mallaha*[33] community. Their major occupation was fishing in the river. Fishing net was their main instrument. They could not survive without fishing net. I had seen them making nets. On that net, I saw same types of many geometrical shapes. I saw different geometrical shapes on different nets. I saw circular shape, square, rectangle, parallelogram and pentagon before getting a formal knowledge. I was surprised by their net making process. His (one of net maker) estimation was interesting for me because I had seen and talked to him many times. One of the net makers was *Jungu Mallaha* (nick name Junge). He was a good estimator. He would take fix amount of thread for fix round and it was correct estimation. So I was enjoying his net making process. He had done many mathematical things without knowing names. I mean we may mathematics everywhere, but I was thinking that the

[33]One of the castes from Madheshi community whose major occupation was fishing

mathematical works I learnt from books during my study at school level were my only mathematics.

When I was a child, I made many more geometrical shapes at the time of playing games on the road. Now-a-days we can see street mathematics separately, but my street mathematics was interesting because I knew geometry which I learned in primary mathematics course without knowing their names, without solving algorithmic problems. People do not want to see the relation between street mathematics and the school mathematics (Bottle, 2005). Later, I could not see any relations with my local practice and my school geometry content. Real life problems may help students construct meaningful understanding of mathematics (Poudel, 2010). I agree with (Boate, as cited in Poudel, 2010) that when the context is recognized as a power determinant, then an educator feels that everyday life context is easier than the abstract context. This does not mean that an abstract mathematics is not important, but it is a matter of purpose. I am also aware that everyday context is not appropriate for students' understanding of mathematical concepts.

I tried to link my previous geometrical concepts with my school Geometry content. 'Only the names were different but the meanings were the same'. While my teacher was teaching Geometry in primary level, I would give examples from my context. My other friends were also giving examples from their own context. Children can bring a lot of local issues of application of mathematics from their household practices to classroom that can help students to understand the value of learning mathematics and also it makes learning mathematics a fun (UNESCO, 2008). I saw mathematics everywhere, but I was doing it on my notebook and thinking it was the mathematical world. I had done many more mathematics within my society but did not care about it on my formal mathematical learning time. “Mathematical ability”

sometimes translates into skill in resolving ambiguities from contexts, or skill in interpreting the tacit assumptions of teachers, textbook authors, examination writers, or the "school mathematics culture." (Goldin, 2010). So I did not care about my misconceptions. I could remember mathematical process but I was totally unaware of it. Sometimes I saw the same situation from my friends' behavior. I had seen different types of mathematics from other people in my society.

In my society, *Mallaha* had their own measuring system also and they would sell fishes from their own measuring instrument. One of the fishermen, *Junge* had one *Dali*[34]. He would sell fish by using that measurement scale. My father was renowned person of my society. Everybody knew him very well. He was supposed to be a good social problem solver. I also saw him helping others many times. Sometimes local people would give him gift. They were not able to give any special gift, but they would give their local products. On those gifts, I saw different types of geometry. I collected *Dhakiya*[35], *Khachi*[36] , *Machiya*[37], *Deli*[38]. Those things were local materials for my geometrical learning stage. I learned circle, various lines like; curve line, straight line, and parallel line from those materials without knowing their names. But I did not learn slanting line from those things. Knowing is always about relationships. We need to know different things for different purposes, and sometimes we know some things for some purposes but not for others (Eisner, 2008). So every

---

[34]A pot made up of bamboo

[35] An artistic pot made of straw

[36]Pot made from roots of plants

[37]Chair made of straw, thread and bamboo

[38]Pot made of straw specially made for temple's purpose

mathematics learner might develop the relation with their daily life activities and mathematics.

Since I was from a village background, I did works on the field, I reared goats on the field, and I fed cows and buffaloes. Now I can relate those things with my mathematical knowledge, but that time I was unable to contextualize them. My mathematics teacher also taught me a text book problem only which is why I could not contextualize my mathematics. While taking care of animal, it was important to feed them nourishing food that contained green grass, thatch of rice and wheat, maize powder and remains of vegetables. It may be a context of teaching set, fractions, ratio and proportion, percent, measurement and so on. There is direct relationship of nutrition in the food and milk they give (UNESCO, 2008).

According to my experience, every teacher might relate mathematics with their students' context. If students get small tricks for that, then they can relate everything with their socio-cultural practices. Ethno-mathematics also may help to contextualize mathematics. Ethno- mathematical prospective has been contributing to a transformation of the traditional concept of euro-centric and mono-representational system of mathematics towards context-based and multi-centric concepts (D' Ambrosio, 2001). Ethno-mathematics does not study only the number systems and symbols of different ethnic groups but also the representational systems of their mathematical knowledge (Luitel, 2007). Local resource and local mathematical belief system are also valuable for contextual mathematics development stage.

I was feeling happy with my learning of Geometry with local learning materials. Local learning materials helped me a lot in developing conceptual understanding of mathematics. I learned addition, subtraction, division, geometry and

more other mathematical concepts from local learning materials. Local mathematics and learning materials also might be instrumental to enrich learner's knowledge.

Chapter Summary

Learning something contextually could bean opportunity for active learners. Life situation can change our thinking style. If a person changes his/her thinking from a traditional pattern, then he/she may do more than the previous work. A positive attitude towards learning is necessary for every individual. The productive form of knowledge was knowledge of how to make something (Eisner, 2008). So if a person can make use of his/her knowledge productively, then he/she may do something different. Decontextualized mathematics may help develop learner’s negative attitude towards the mathematical teaching learning process. If a person sees both conditions of mathematics, then he/she may be able to change their thinking towards it. Whenever I saw mathematics in my practice, I felt quite comfortable compared to the decontextualized situation. Thus, both the concept and context are equally important for me. Decontextualized mathematical questions presented above might be critical for mathematics teacher, teacher educator, textbook writer, curriculum designers and policy makers.

CHAPTER VI

JOURNEYING INTO THE WORLD OF REFLECTIVE PRACTICE: A LIFE FRACTAL EXPANDED TO HORIZON

Chapter Overview

This chapter recounts my transformative moments of learning mathematics from my preliminary school at a village to my study at Kathmandu University, possibly from a traditional mathematics teacher to a constructivist teacher. This chapter attempts to address my research question, 'How could my teaching learning process help me understand mathematics practically?' It also shows the gap between teaching learning theories and my learning context. Furthermore, the chapter also presents how I have transformed to an activity-based mathematics teacher. This chapter also shows critical points of my professional life and the beginning of my professional life that emphasizes on how non-academician transforms his/her life into a true academician through relentless adventurous academic journey. I am trying to show my journey under the following themes;

- Starting phase of my teaching journey
- Teaching mathematics in mother language
- My decision to join Master's in Mathematics Education
- Teaching business mathematics for the same grade student
- In pursuit of practical mathematics learning station
- Transformation, Really?
- Near to dropout

- How critical research in mathematics pedagogy course changed my direction of life
- Internship: A new practical experience with new hopes and ideas in mathematics teaching
- As a novice teacher
- Challenges of activity based teaching in Nepalese school mathematics
- STTP program in mathematics and my achievement
- Critical teacher researcher

Starting Phase of My Teaching Journey

It could be around nine years ago. After I passed my SLC exam, I started to teach home tuition for Grade Eight to Ten students. Nearly for three years, I taught them at my home. My tuition class was informal. The way I was solving algorithmic problems was very structural. At the very beginning of my class, I taught for my age group students. I was unable to control some of their negative voices. I did not have any instructional ideas, but I taught for tuition class according to the context of time. I was teaching student for my pocket money. I was not interested in teaching mathematics. Actually, we need to write more while solving mathematics problems. But I was feeling lazy about writing. I was getting just Rs 250 per student in a month. And, I was unable to collect more money from the tuition class at the very beginning. Although I dared to take mathematics tuition class, I was not a good teacher for the Arithmetic portion.

Sometimes word problems irritated me a lot while teaching mathematics to Grade Nine students. Does this mean that I was a mechanical teacher who would fill in the blanks? That time I was about 16 years old. My interest was with teenager friends. I also had the same feelings that the teenagers usually had in my time. But the teaching of mathematics was my job without interest. Every day at morning period, I was busy with my college study. And in the evening time, I had to be busy with home tuition classes. I simply would solve 2/3 problems and assign them more tasks which was my routine of traditional teaching. Each group had got 1 hour study time with me. I was not making groups with constant members because I was in personal economic crisis stage. My mother was also happy to see me teaching because I was not spending my leisure time with other teenager boys. And I was collecting pocket money also at the same time. At first, I taught for 8 students who were preparing their SLC complementary mathematics exam for 2058 BC. Out of the eight students, the seven passed their exam by taking 1 month tuition class with me.

I was happy to see my age group with me as students. I was not getting any formal pressure from the students and their parents. I was teaching traditionally, but they were happy with me. There was not any curricular and instructional structure. So I was enjoying with mathematics teaching and learning process. I was learning different teaching strategies through their different personal abilities and beliefs.

People in my community started considering me as good mathematics teacher even though I was teaching them through traditional method. I was teaching mathematics without context. Nevertheless, my students were very happy with my teaching. After the publication of SLC result, one of the girl students whom I taught came to meet me and said, *"It was impossible to pass SLC exam without your teaching because I had got only 12 marks in my regular SLC mathematics exam."* I was very happy to hear those voices. I would teach students

who were bound to adjust on one bench as I did not have well furnished classroom for the mathematics tuition class. We had a small cottage-type house and there were only three rooms where no extra room was available for teaching. My teaching was going on smoothly and I was learning mathematics too because I was studying mathematics at the college level at the same time. Slowly I started to discuss with friends regarding some issues which was my instructional method. I was teaching them by discussing and two-way conversation method since conversation offers a powerful way of accounting for both mind and learning (Ernest, 2010). After one year, I became a popular teacher in my community and some of the students from other places also came to join my mathematics tuition class.

Those who were taking my class were reflecting on my new way of teaching. They were feeling uncomfortable with their school teacher because that was their formal class. But I was behaving them informally in a friendly manner. Sometimes they wanted to talk about their personal talks to me and I also would share my views with them. My experiences about teaching assume that informal talks also may play positive roles towards mathematics learning.

My teaching learning process was going on satisfactorily as there was nobody to control my teaching activities. I was the ‘supreme’ figure of that informal mathematics tuition class. I was gradually becoming powerful personality in my society. I became a 'counted person' of that society. People of my society did not try to criticize my practices even though I was not teaching mathematics with the connection of our cultural values and social structure.

Decontextualised mathematics (Luitel, 2003) made me so-called a powerful and popular teacher in my situation. Using appropriate formulas and applying them for solutions was my process of doing mathematics. Finding answer on the note book

was my teaching process. I was enjoying with teaching because there was nothing to think about its effect in the long run. Nobody questioned me about that because they might feel it was the only process of learning mathematics. All of my students came from a village who would do their household activities accepted my methodology of teaching and learning mathematics. I completed their course without connecting with their household activities. After some time, I collected feedback from few students and they gave good responses regarding my teaching although I taught them according to traditional method of teaching. Despite all these, I have these questions my mind: What does it mean to be a good mathematics teacher? Am I really a mathematics teacher? Do I really know mathematics?

Teaching Mathematics in Mother Language

Next time, I started to teach tuition classes at another village also where I would go to market nearby my home. I mean I was popular as a good mathematics teacher even in other neighboring villages also. Local people of that village were originally from *Madhesi* background. Their mother language was *Bhojpuri.* Sometimes I was teaching them mathematics in *Bhojpuri* language and my medium of instruction was *Bhojpuri*. I taught them using their own mother language. That is why I was appreciated by them. An experience says that language is also an important part of learning process. Without understanding teachers' language, students may not get actual concepts which their teacher wants to give. Language also can help to contextualize students' mathematical understanding. Whenever I explained in Nepali, the students felt quite uncomfortable with my teaching, but became curious to learn when I used the students' own mother language.

One day one boy came to meet me. I was teaching mathematics to a few students at my home at the very moment. The boy looked like a worker in a Brick

Company as he was dressed in rags. Here I am going to present our dialogue in local language of western Terai, Nepal.

Unknown Boy: *Sir hamar baap kahale rahe ki tu ganit k class lehat bata, ham hu padhek chaahat rahali mili ki nai mili?* (Sir, my father informed me that you are teaching mathematics tuition class. So I would like to join the class.)

I*: kaye me padbe re tu* (In which class do you study?)

Boy: *ham nau me padhat bati* (Grade 9)

I: *kaun school me padbe* (What's your school's name?)

Boy: *murgihawa* (Murgihawa, the place where his school is located)

I: *Ha! hamar paas tohar class se 6 mila padhatbata, aayek ho to bihan se aayo, saam ko chhau baje*. (Yes, I am teaching six students from your class. If you want to join, come from tomorrow evening at 6pm.)

Boy: *aachha sir bihan se aab padhe* (Ok sir. I will come from tomorrow).

I: *ha padhek ta aawa bakin paisawa to chaahi na* (Ok. But you should bring money).

Boy: *paisa deb sir* (I will give you money).

I: *ke dei tohar paisawa* (Who manages your fee?)

Boy: *hamar baap dei sir* (My father, sir.)

I: *kab dei* (When?)

Boy: *padheleke baad me baap dei* (After finishing your class, my father will give you money).

I: *padhbete mahina me 250 rupaiya lagi. padhai suru hone ke ek hapte me chaahi. sakbe ki nahi* (You should pay 250 Rs per month after a week of starting date. Can you pay?)

Boy: *aachchha sir aaj ham baap se kahideb, milite bihan se aab.* (Ok sir. I will tell to my father and if I can manage it, then I will come from tomorrow.)

After two days, he gave me fee and told me that he was satisfied with my teaching and wanted to learn mathematics in *Bhojpuri* language. Our national curriculum prescribed language was Nepali, but the students who were especially from *Madhesi* background were facing a huge challenge and difficulties for it since Nepali was their second language. They were not able to understand mathematics in the public school because all the public school's medium of instruction was Nepali.

Teaching Business Mathematics for The Same Grade Student

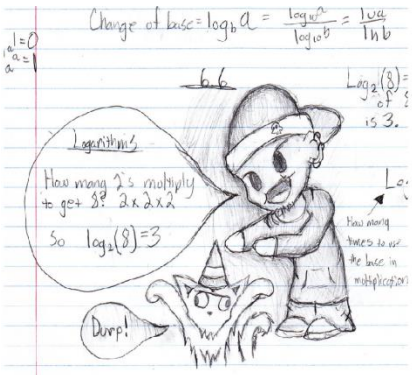
Teaching mathematics for the same grade student was fun because I did not feel any hierarchy between a teacher and a student. All of them were my friends. So I rather treated them as friends and not as mere students. I also felt comfortable with them because when I was unable to find answer easily, I easily told them that I was also learning. So let's do together.

It was around 2.00 PM of any day in November 2003. One of my friends came to meet me at my home. He asked my mother about me. My mother did not know about my outside activities. She sent one small boy to call me at home. The small boy started to look for me but he did not find me. He returned back home without knowing my presence. That time I was playing cards with my friends. It was the time of learning to play cards for me. I was learning to play cards by spending a small amount of money. Nearly at around 5 pm, I finished my game and came back home. My mother started to shout at me because I had not informed her about my activities. My friend who had come to meet me earlier was still waiting me. He was studying in Grade 12. He had actually come at my home to propose me to take Business Mathematics tuition class for him. I said, "I will give you my final decision tomorrow. But you need to give me your text book today". He agreed and lent me his Business Mathematics book. I went through the whole book and found no difficulty to teach that textbook for tuition class. After two days, I decided to teach Business Mathematics to him and his friend.

I would practice algorithmic problem solving at night to teach them the next day. They were satisfied with my teaching. Just solving the problems and finding the answers was my pedagogy for them. Writing on the notebook and showing them the process was my teaching strategy. Actually I taught them Derivative, Anti-derivative and Tangent very well. But I taught them other chapters just for formality. Sometimes the word problems tortured me a lot, but I faced them. In the preparation time, I practiced by writing till late night. Writing the same problem time and again was my strategy for memorization. But at the heart I was asking myself: Who is this Toyanath who pretends to be a teacher? Do I really speak through my inner heart when I say I solved mathematical problem for them?

New Step for Master's in Mathematics Education

It could be the month of March in 2007. I was enjoying with my friend in *Tahajiya Mela*[39] in my village. One of my friends, *Dayaraj* called me to inform about our B. Ed. 3rd year result. I was sure about my positive result before his information. He informed me that I had passed the exam. Immediately, I went to home and informed my mother. I was very happy to hear that because I was waiting the result



for 10 months. I phoned to my brother-in-law also. My friends had already been to Kathmandu for their master's study preparation, but I had not decided to go for master's degree yet. That day I managed small get-together party for my village friends. My friends were forcing me to join master's degree in Kathmandu. They brainwashed me for study. But I wanted to go abroad for money. I was in a dilemma. Next day, my

[39]Festival of Madhesi people

brother-in-law called me and told me to meet him. I went to meet him another morning. He told me to join master's study and told me that he was ready to spend necessary amount of money. My elder brother also forced me to join master's study and my younger brother was my encourager. After all, I decided to join master's degree at University of Annapurna.

I went to visit the university after 15 days. My other college friends were already there. The admission was announced but there was not any certainty to run the program on time since our country was in the transitional phase and the peace process was undergoing for a new constitution assembly election. I was preparing for an entrance exam but there was no more entrance exam. I spent nearly one and half month to visit and know the central department of mathematics at the University of Annapurna. I filled up form and went back to my village for election. That time I was involving in politics. After constitutional assembly election, I decided to leave political activities and joined the University of Annapurna. I had a different assumption about the central department of mathematics education. I went there to be educated person but the scenario was different. I was expecting more than the reality. I wanted to learn more mathematics in the University, but I was suffering from several unprecedented strikes. Slowly I started to feel adjustment problem with my goal and learning. I was supposed to teach B. Ed. level students after completion of my M.Ed. mathematics course, but I did not get proper direction of life. I started to generalize my conditions. The most important operation of the mind is that of generalization (Rivera, 2011, p.144). So I started to examine my practice and situation. I was judging whether I was in right path or not. People are not only the agents of action but the self-examiners of their functioning (Bandura, 2001, p.267). I

thought I was in a wrong direction because I was not getting knowledge and I was just learning about how to criticize people's work.

In Pursuit of Practical (i.e., Impure?)Mathematics

My internal assessment of the master's 1st year was coming at hand and I was preparing for that. The assessment in Curriculum, Foundation of Education and Psychology in Classroom was taken. Questions were given before 15 days and I submitted my paper according to rule. Some of my friends were involving in the college politics. They just submitted their paper for formality that I saw before submission time. The result was published after 15 days. They got 20 out of 20 without doing anything and I got 17 out of 20 with my hard work. Motivation and learning are connected (Kanar, 2011). I was demotivated by those subject teachers. After that, other mathematics teachers also took assessment and did the same like previous. The marks were divided for attendance but my friend got 19 out of 20 without attendance. I was not feeling comfortable with the assessment system also. According to Talbert (2000), Assessments are ongoing on the reform classrooms, so that teachers and students get feedback on the success of instruction in order to redirect their work but I found just opposite. I was not usually distracted when I was listening to a lecture. Listening everyday same lecture irritated me in taking mathematics class. I was looking for practical mathematics like constructivist classroom. In this regard, Star (2005) says,

> Constructivist teachers inquire about students' understanding of concepts before sharing their own understandings of those concepts. Constructivist teachers encourage students to engage in dialogue, both with teacher and with one another. Constructivist teacher encourage student inquiry by asking thoughtful, open-ended questions and

encouraging student to ask questions of each other. Constructivist teacher seek elaboration of student initial responses. Constructivist teachers engage student in experiences that might engender contradictions to their initial hypotheses and then encourage discussion. Constructivist teacher allow wait time after posing questions. Constructivist teachers provide time for students to construct relationships and create metaphors, constructivist teachers nurture students' natural curiosity through frequent use of the learning cycle model. The learning cycle model consists of discovery, concept, introduction and concept application (p.16).

I was hungry to get practical mathematics education. I tried to search an alternative for my M.Ed. at the University of Annapurna. I started to consult with different people about the practical mathematics education class. I learned Projective Geometry practically there but not other subjects. Actually Statistics and Geometry also can be dealt practically, but our teachers merely applied a chalk and talk method of instruction in our mathematics classroom. Our duty as a student was to copy note provided by the teacher without explanation. That time I had only two options; either to leave M.Ed. study or to look for practical mathematics learning station.

Master's Algebra Tuition Class as A Transit Place of My Career

It was around November in 2008 of any Friday. I went to stay at my friend's room at Kirtipur, Kathmandu. My elder brother called me at around 8:30 pm and asked about my study. He encouraged me to get excellent mark in mathematics. For

that, he told me that he could manage for my study at any cost. I mean he gave me green-light signal for money, but I needed to get excellent marks. I was in pressure because I was not learning well in the University but my family members were giving me pressure to get excellence marks. I knew about my condition. My friends, Pramod and Narayan were also in the same problems. I and my friend, Pramod discussed whole night about that. Early morning the next day, we decided to join Algebra tuition class. The teacher was a popular algebra teacher among the University of Annapurna of mathematics students. He was the only algebra teacher who could present a concept on Algebra. When I was in M.Ed. mathematics at the University of Annapurna, I learned many more theorems from Algebra in an impractical way. I would ask practical questions and their application in real life in that class with my mathematics tutor. Nevertheless, I was satisfied with his teaching. Fortunately, I met one guy who was also studying at KU. He told me that KU was a far better place for me to address those questions. Regular conversation with him and the algebra teacher changed my mind setting. Experiences of KU students also helped me make a decision to change institution for my master's study. Experiencing a situation in a form that allows you to walk in the shoes of another is one way to know one aspect of it (Eisner, 2008).

I had made decision over my head to join KU, but it was very difficult to convince my family members because I already promised them to do well in my study. According to my family members' view, I was forgetting my ground reality and simply trying to build a castle in the air. I informed my brother-in-law and elder brother about my interest.

Transformation, Really?

I was studying at the University of Annapurna then. It could be any day of January in 2009; my younger brother, Khem bought a newspaper and saw an

admission notice on that. Immediately, he dialed up at University to know about the admission announcement. I and my brother went to visit University. We met M.Ed. coordinator of KUSOED. Actually, my brother Khem played a very positive role for my University entry. Once I had seen a power point presented on ethnomathematics performed by a senior KU student. I was excited to do that because I had not seen any power point presentation before in any of the mathematics class I had ever attended. I thought the University was the sole institution where students could learn mathematics practically. I saw some contextual examples in that presentation. I kept on thinking that the University could develop my presentation skill and technical knowledge in teaching and learning mathematics. I wanted to connect my every day mathematics with our textbook mathematics. I wanted to see mathematics with reference to its context. I had not seen that kind of mathematical power point presentation because of my socio-economical condition. Mathematics tasks in everyday contexts can mislead students from low socio-economic background into privileging the everyday context and the meanings carried in them over the abstract or esoteric meanings of the discourse of academic school mathematics. Thus these students are not able to demonstrate the knowledge they have as the context has distracted them, the rules for recognizing what they are supposed to do being hidden (Lerman, 2010).

I came to give my entrance exam for M.Ed. mathematics. I was preparing about mathematical content, but the questions were different. All the questions were open-ended and conceptual. That entrance paper also made my strong belief towards KU. Finally, I joined and started to study from February 2009.

Near to Dropout

I was expecting more but my mental belief was pretty much structured as I held the belief that good teaching and learning are explained by decontextualized delivery and passive reception. Before joining KU, I learned many things through self-study. I never wrote reflection of class and content, I never presented and participated in a group discussion and I never got deadlines for homework or assignment. During the very starting classes at KU, I thought that teachers were not doing their work but they were shifting their burden of work towards students. I studied constructivist approach, cooperative learning, collaborative learning, pragmatism, theoretically but not practically. I saw different teaching strategies and most methods were student centered. I thought another degree was running at University of Annapurna and I inadvertently thought that it was appropriate time to leave KU because my mistaken beliefs suggested that teachers of KU were not giving full-fledged knowledge as they were merely forcing us to search for new ideas.

Our teachers tried to help us to construct our own knowledge through constructivist ideas. Constructivist teaching/ learning approaches are based on a philosophy that teach individual define knowledge in relation to his own experiences both in isolation from other people and in a social setting (Von Glaserfeld, 1989). In the name of constructivist idea, teachers were giving us more works. As a result, I wanted to leave KU because of teaching methods after three months. Actually I was poor in English and I was unknown about different teaching ideas. So I thought KU was not appropriate place for me. I was best fitted at University of Annapurna. My desires for practical knowledge were dead. I was in problem because I convinced my parents for KU admission before three months. But

I was feeling shy while giving presentation in front of my friends because of the level of my English.

it was really difficult job for me to convince them right after three months. It was my problem. I was worried about my English also. My English was poor and my friends had good skills in English. I did not want to talk in English because of my poor performance. Sometimes I felt shy to present something in front of all friends. I shared my feelings with one of the teacher of KU and he said to me, “you can do more if you change your attitude.” Furthermore, he suggested me that I change the way. I see the world of teaching and towards learning. Gradually, I began to see some lights on the horizon.

How Critical Research in Mathematics Pedagogy Course Changed My Direction of Life

It was the first day of 3rd semester. There were options to choose courses. Two subjects were optional. I had to choose either analytical mathematics or research in mathematics pedagogy. My two friends decided to choose research in mathematics pedagogy course. I have chosen analysis mathematics. But my friend informed little about research in mathematics pedagogy. I asked him who would teach research in mathematics pedagogy. My friend said to me, ‘Luitel sir will teach us'. Then I went to meet Dr. Luitel. At first, he asked me about my aim. I told that my aim was to be mathematics educator and trainer. Then he told me that if I wanted to do something more on pure mathematics, then mathematical analysis would be better but I wanted to do something on pedagogical part. He suggested me that research in mathematics pedagogy would be much better.

Before starting the course, I asked some questions about my future aim. After all, I decided to choose research in mathematics pedagogy course. Dr. Luitel was my tutor of that course. He had just completed his PhD and returned back to Nepal at that time. He started to teach us the very course. At first, he gave us the paper Teacher as a

Researcher by Kincheloe. I was learning constructivism for whole long one year but I did not get actual constructivist teacher before. He would support me for each and every task. Slowly I started to reflect my previous practices. I was transforming gradually, yet significantly from my old paradigm of learning to new paradigm. I started to construct my own meanings towards mathematical content and tried to relate theories with my cultural practices, Transformation happens when people managing a system focus on creating a new future that has never existed before, and based on continual learning and a new mindset, take different actions than they would have taken in the past (Daszko & Sheinberg, 2005). Perhaps, my beliefs were shifting from old to new paradigm. The experiences and knowledge that the students bring to a classroom have a significant effect on the way they learn new information. We taint everything that we learn with our own beliefs, conceptions, and perspectives that we held previously. By learning something, we make it ours, thus leaving our prints on it just as it leaves an impression on us. (David, 2002 as cited in Sarah, 2006). I started to reflect critically on my teaching and learning mathematics. I started to link my practices with theories, philosophies and my own personal beliefs as the teachers are opportunities for all to engage in shifts of theories, thoughts, or philosophies (Sarah, 2006).

I hope to have changed my direction through continuous dialogue with Dr. Luitel and new trends of teaching and learning mathematics. Without ongoing critical dialogues between their old and new assumptions about teaching, learning, and literacy, their new assumptions could not become fully transformative (Sarah, 2006, p. 53). I started to write some reflections towards my old practices. I was trying to become critical researcher. Reflection on action, reflection for action and reflection in action became my part of writings. Critical teacher researcher became classroom

technician to active political and cultural agent who is reflective thinker and who might develop his/her own vision. I realize that reflection in action might be the best way for teacher researcher. Systemic reflection within a practice of teaching could be more effective for teacher researcher and it might help to develop teachers' professional development also. I started to reform my instructional practices. Exploiting professional opportunities is essential to reforming instruction (Talbert, 2000). I was trying to become professional through reflective practices. Before taking that class, I was not sure about my further learning direction. Davis (1996) also says, "One never knows exactly what one will learn" (as cited in Sarah, 2006, p. 90).As I had gone through Kincheloe (2001), I got his critical theoretical idea concerned with social relations. It focused on individuals understanding and prospective on his /her meaning making process. Reflective attitude is the most important parts of teacher researcher. Being critical means to not only criticizing others voice, knowledge and experience, it is a meaning making process and real reflection of practitioners voice, knowledge and experience. Kincheloe further focused on reflection and meta-analysis of socio-historical context on teacher education programme. It means teachers need to develop their reflective thinking on action and also need to again and again thinking on his/her analytical approach and result. So I also became my own practice-analyser with my cultural-political condition.

Internship: A New Practical Experience with New Hopes And Ideas in Mathematics Teaching

I was in the 4th semester of M.Ed. mathematics class. Internship was compulsory practical course for us. At the very beginning of our class, I was planning to conduct secondary mathematics training program being a trainer. For that I did need analysis for different level mathematics teachers. Class observation, interviews

were the major tools used for my data collection. I had taken different interviews and class observation in both public and private school teacher and inside the Kathmandu valley and outside the Kathmandu valley. I found the need of training on conceptual teaching in geometry. I was preparing for that and designing sessions for training. All of my class mates were preparing for teacher training program. I also delivered one mini-training module. But at the same time, I got information about training options.

The University provided us two options; either we can go to practice teaching class with at least 60 lesson plans or teacher training. I was not interested in teacher training program because all the KU mathematics students were conducting teacher training since 2006 batch as their Internship requirement. After consulting with my internship supervisor, I wrote letter of interest to the department head and internship supervisor for practice teaching and Math Camp. I proposed one school from Kathmandu valley in my letter. I got the letter of permission from that school and I submitted it to my supervisor. I did my internship in Math Camp as a program coordinator. There were my other friends along with principal of the school also. At the very beginning of my class in practice teaching, I was unable to explain each and every thing in English. Sometimes I felt shy with others.

My internship program was not possible without my internship supervisor. Eventually I conducted internship training successfully with his regular involvement, feedback and suggestion. For that program, I planned each and every activity for 15 days. I selected 42 students for the very camp according to their performance. I took low achievers mathematics student for my activity-based Math Camp. Out of 42 students, only 34 joined the program. In that program, the students played games in mathematics; they did many more activities without any feeling of classroom teaching. The students were enjoying with that program. Applying different ways in

teaching mathematics was a challenging task for me. I wanted to start different new program in internship program. I had not heard Math Camp before. So I decided to do that different task. It was really challenging for me to convince school management, students, parents and my internship supervisor. We were unable to do according to my plan for the first two days. After that I changed my program and went through students' level of understanding. That program was especially for grade five and six students. Every day the students would reflect their feelings through journal writing process. I was also writing reflection about everyday program. We were following continues assessment system for them. At last, I had not seen any significant change in two students but others had comparably become good students of their class. Last day, we organized parents meeting for feedback. All the parents were very happy to see their children's increasing achievement in mathematics. Somehow I was able to minimize their mathematics anxiety.

That program was conducted during their winter vacation. In initial days of the Math Camp program, some of the students wanted to take rest or wanted to go outside the valley. As I was sending letter to the parents for the confirmation of their child in the program, one of the selected students came to meet me and said, "*Sir, please do not send letter to my parents because I want to go to Pokhara for a week. If you send letter, then they will definitely cancel my Pokhara visit program because I am very poor in mathematics. They want to see maximum marks in mathematics on my mark sheet*." After the end of the program, I asked to the same student about program and his achievement. He said, "*I had never seen this type of mathematics. Thank you sir for not listening to my voice. Earlier I requested you not to give letter to my parents. But you gave and I joined the program by canceling Pokhara visit program. I am very happy with that program because I understood basic things and now I can play with*

*mathematics. And I can go to Pokhara the next time, but I may not get that sort of program again."*I again met with critical comments towards my choices for the pedagogical focus of the program. I become more confident on activity-based teaching mathematics. I can say that the internship program enhanced my confidence level in this transformative journey.

As A Novice Teacher

It could be any day of December in 2010. One of my friends called me to meet at KU. I was doing assignment for seminar issues in mathematics education. I went to meet him and he proposed me teaching job at another colleague's school in Kathmandu. I was not thinking about job because I wanted to complete M.Ed. first. I told him to wait for two days for my eventual decision. I asked with my brother-in-law about the proposal of job and he told me not to join teaching job which could ruin my study to some extent. But my elder brother told me to join teaching job, provided I could manage my study. Finally, I decided to join asserting that I could manage my M.Ed. study and my dissertation writing project. I asked principal to provide time for my research after I finish taking my class. She agreed upon my request and then I started to teach. It was my first formal teaching in an established institution.

In the beginning, I felt quite difficult to adjust with formal teaching process. Since I had already changed my direction, it was challenging task for me. I wanted to teach them through activity-based pedagogy. I started to teach them by using instructional teaching materials in mathematics. I was using different approaches for them to teach mathematics. I continued to contemplate how to encourage my students to embrace their perceptions of learning, even as I search for ways to foster moments that might bring about epistemological shifts in their (and indeed my) perspectives. Using this dual approach of embracing and transforming, my teaching experiences

continue to be both challenging and engaging (Sarah, 2006). I had learned more about teaching mathematics. I guess I kept thinking I would teach mathematics the way I was taught, but this class made me realize there are many different approaches to teaching mathematics. Before that I was unaware of the theories and epistemologies that underline the teaching of mathematics (Ernest, 1990). I have learned it could be ok to allow students to explore and discover ideas. Also, I think it might be good for students to struggle with ideas. I learned this with fractions! This struggle made me appreciate this concept more. Now, I feel I have a positive attitude about math (Spring, 2005). Sometimes my teachers believed on mathematical mind. They would say for good mathematics learner, mathematical mind is necessary. But I do not think it exists. I think everybody can do mathematics if they try to link it with their socio-cultural aspects.

Being able to think mathematically is also the political word because mathematics is linked with power and social status. Real world is attached and everything is interrelated, so mathematics and our societies are also interrelated. Mathematics always helps society for problem solving (Keitel, 2009). So as a novice teacher, I faced those kinds of environment as I was simply like a '*man with no name'* (Kincheloe, 2003).As a novice teacher, I need to experience the research process in ways that allow me to articulate and reflect on my personal versions of teaching rather than merely imitating the articulations of others. (McWilliam,1994, p.149).

Traditional mathematics teachers try to make mathematics powerful subject to exercise their own vested interests. To my experience, they actually wanted to make mathematics as hard subject for society because they want to sell it according to their way. My colleagues were making mathematics hard subject but I wanted to break their conceptual myths of mathematics. I was feeling uncomfortable with my

colleagues because of their rigid beliefs about mathematics. They would beat students and I was just against their attitudes and behaviours. I always tried to motivate students through different techniques. I was more flexible teacher for my students. I never prescribed any rigid way of writing and doing mathematics. Flexibility is one of the key traits of a confident student. Learning to be flexible in your daily activities prepares us to meet life's greater challenges (Kanar, 2011, p.2). My colleagues were thinking mathematics teaching learning process as a Jug and Mug process whereas the students' mind is not *tabularasa* (Paudel, 2008). So we need to think about alternative solutions of each and every problem. I think it is not better to consider anything absolute. Different society can give different solutions for problems. Mathematical learning should be viewed both as a process of active individual construction and process of enculturation into the mathematical practices of wider society (Cobb, 1994). So mathematics teacher should think about multiple solutions for particular problem. There may be chances to get new ideas about it.

Challenges of Activity-Based Teaching in Nepalese School Mathematics

It could be any Wednesday of March in 2010. I planned to teach circle for 6th grade students. There was no more resource except circle boards and threads. Actually my plan was to show the relationship between diameter of circle and its circumference. I took some different sized circle boards and threads for classroom materials. I was going to show the value of pie through that activity. The students were divided into different groups having four members each in a group. There were around 40 students in a class. At first, I taught them about simple concepts of circle and its parts. After that I gave clear instruction about the activity. They started to do their activity. At the same time, senior teacher was moving around and he saw the

ongoing activities through window. I was doing my work without taking care of senior teacher. Then I finished my class according to my lesson plan.

The senior teacher called me after the classes were over and told me that my class was noisy and rather haphazard the very day. He also warned me to manage calm environment within classroom for teaching and learning activities. I was surprised but I did not show my disagreed face to him. I told him that there were more students and I wanted to run my class with different group activities which might sometimes create noise. I also assured him to manage and control the class gradually. After returning back to home from school, I thought I was totally a failure (teacher) according to him. I reflected all the activities that I had done before in school. I did not like to teach student from traditional (lecture method) way. I was in critical condition. Either I had to convince him with my instruction or I had to change my teaching approach. My approach was different than other mathematics teachers of my school. A good teacher is someone who is able to attend to the students needs and assist each person in the way that he or she learns best (Brandes & Ginnis, 1986, P. 53). I was passionate about teaching mathematics from the perspectives of new trends. I would encourage my students to write about their own mathematical experiences, how those experiences have shaped their perspectives of learning mathematics, and who they believe they are in relation to mathematics, hoping to bring what was previously hidden to the foreground. I almost failed to teach students according to traditional views. I was thinking it time and again. I woke up in the morning with a dream that enacts a situation that I experienced the previous evening with a new twist. The dream is a way of knowing, and it stimulates responses and attempts to understand it that collaborates with other modes of cognition (McNiff, 2008). I had decided to talk about situation whenever he raises the issue. I was clear about my

directions that I had set with the help of Luitel and Pokhrel. Traditional teachers think student take what I give them and make it their own. My instruction, therefore, must proceed from this point. (Kincheloe, et al.2000). Further, Kinchole et al. (2000) state, "While the past informs and conditions the present, every moment also contains possibilities for change and new directions" (Laura & spring, as cited in sarah, 2006, p.309). I made my direction strong because I already knew about our physical and psychological conditions of students, parents, school managers and mathematics teachers. There may be many factors like number of student in classroom, resources of teacher, teachers' skill and beliefs, students' willingness to learn mathematics, curriculum and content, parents' expectation towards learning and our assessment systems might be the influential factors for activity-based mathematics teaching and learning process.

STTP Program in Mathematics and My Achievement

It was the first time experience for my long term teacher training program. In the month of July in 2011, I joined secondary teacher training program in mathematics for three months. I wanted to become teacher educator before which was my destination. When I joined KU in mathematics education, the course aim was to make a secondary mathematics teacher, to make a teacher educator or trainer and to make a teacher researcher. I became near-to-teacher-researcher because I started reflective practices on my own profession. My next task was to prepare myself as a trainer. So I thought it was a good time to join STTP program in mathematics and develop my professional skills.

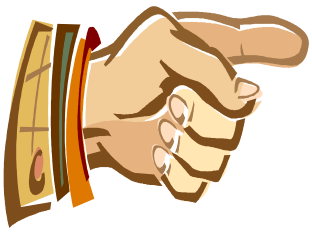
I believe that teacher educators have the responsibility to be self-reflexive in their own pedagogical work. It is not enough for novice teachers to be critical, reflective inquirers; teacher educators must engage in the same endeavor. Transformative

pedagogies imply that all engaged in the process will be changed (refers to both teachers and students). An example of researchers who consider their own transformation in light of pedagogical practices (Ritchie & Wilson, as cited in McWilliam, 1994). Teacher educators' idea influenced by the stories and theories of others is a complex interpretation. Rather than seeking to reify what they already know, they seek to be transformed in the interactions and also engage in their own self-reflexive work. Telling and listening to stories can be powerful sign of regard–of caring–for one another (Taylor, 2007), but I did not get that program anymore because I came to know about my belief systems. Teachers can apply any pedagogical practice if they change their beliefs. My experience says that it could be better to make one most important aim of teacher training program to change teachers' belief system towards teaching and learning process. Whatever I had learned there, they were all provided by KU, school of mathematics education. I did not get other special teaching learning matter except the concept of child psychology as the main aim of that program was to include activity-based mathematics in school mathematics teaching. Teacher education provides little inside into the forces that shape identity and consciousness (Kincheloe, 2003). However, I transformed myself from my traditional beliefs of mathematics teaching as it was one of the types of teacher development program for me as it could be assumed thatTeacher development programme might be the most important factor for critical teacher researcher.

Critical Teacher Researcher

As I have gone through Kinchole (1991), I came to know about critical teacher researcher. Research in mathematics pedagogy course made me critical thinker on my everyday teaching and learning practice. I have many challenges to develop my critical thinking ability in the educational field. Teacher-deskilling process is

increasing because of educational managers, they are autonomous and they see educational field from business point of view and there is one great challenge that teacher always thinks of any subject area or his/her



knowledge is always guided by positivistic view or within some structure or framework that affects on teachers creative thinking and he/she never becomes a critical teacher. Critical research might reject the positivistic perspective of rationality, objectivity and truth. Critical social science promotes self-reflection which results in attitudinal change (Kincheloe, 1991). Self reflection and self questioning are the key terms of critical teacher researcher. By the help of Kincheloe's paper, I became critical teacher researcher because I started to reflect myself with my social conditions and I started realizing change from within (Kincheloe, 2003) afterwards gradually.

Critical research helps me to think about my cultural, political, historical background and my contextual background. It helps to link social theory, educational theory and professional lives. Critical research develops the researcher's way of knowing and increase creative tension in knowledge generation process. Particularly in mathematics class, a teacher researcher might be able to develop participatory pedagogies with the help of such research. Self questioning might also help to think critically as it is the central point of critical teacher researcher and it helps to gain or construct new knowledge from self reflection.

Traditionally-minded teachers feel that they are only reactors not reflectors and they do not have any power to express their voices and experiences. But I am trying to reflect myself as basis for finding a space for voice. Reflective attitude is the most important part of teacher researcher. Being critical means not only criticizing

others voice, knowledge and experience; it is a meaning making process and real reflection of practitioners' voice, knowledge and experience. What am I doing at this moment is questioning myself like; what are my practices? What is the reason behind these practices? How did I use these into my practice? If all the questions are answered by me, then I think I am in the first phase of being critical. So, being critical means being able to challenge not only others theories and practice but challenge own facts, feelings, practice so that a reformation will be seen today which might lead to positive transformation tomorrow. Critical educators work to emancipate students by engaging them in classroom dialogue aimed at deconstructing the hegemony of repressive ideologies (Taylor, 1996). Thus it may be argued that self is the centre of critical teacher researcher.

Chapter Summary

In this chapter, I have presented some of my life experiences from teaching journey. Actually, this chapter shows my journey from non-academician to academic person. My narratives and personal feelings given in the text box may reflect the scenario of my teaching learning journey. I crossed long bridge from 'informal teaching to formal teaching, traditional teaching to new pedagogy of teaching, traditional researcher to critical teacher researcher, untrained teacher to trained teacher and hopeless identity to identity with new hopes'. I crossed it but it was not working properly. Thus this chapter shows my journey from easy life to difficult life because 'less knowledge less problems and more knowledge more problems'. Previously, my life was detached from educational world to greater extent and I did not have any dream for life. Now my eyes are looking towards my next world so as to find the way for my next direction of life as a critical-teacher-researcher and a transformative teacher, teacher educator.

CHAPTER VII

CONCLUDING MY JOURNEY: PAVING AN AVENUE TOWARDS ACTIVITY-BASED MATHEMATICS

Chapter Overview

In the journey of writing autoethnographic research, I have shown my different natures; my nature as a mathematics learner, as a mathematics teacher and somewhere as a researcher. I have presented some of my learning and teaching experiences from different socio-economical condition and from different stages of my life span. As a reflective practitioner, I have shown my reflections from different experiences. At the very beginning of this research, I tried to explore different influential factors and facets which might be the factors for conceptual mathematics teaching and learning process. In my journey from a student to a mathematics teacher, I always focused on my better understanding of mathematical knowledge system. I gained different sort of knowledge from teacher training and mathematics teacher education programs, which, I believe, might be directly involved in this transformative process. While I was reflecting on my past, I realized that it could also be one of the important factors to learning and transforming process of an individual. On the process of searching myself in the educational field, I have crossed a long journey of learning and teaching mathematics. I was searching light in the dark room and now I have found windows of hope and I might find door and light as well.

Remembering past events was hard task for me at the very beginning of my research writing process. After writing some past experiences, it was very difficult to

fit my narratives, story and dialogue into my research agenda. Connecting and comparing those experiences with theories was another important task for me. Finally, my chosen research method and methodology supported me to do something in this research. Within that process, I learned some new techniques for reflective practice, some teaching learning theories and research ways. So researcher can change their belief within reflective process. If man/woman starts to reflect his/her practices, then there are ample possibilities of transformation. This chapter shows my research conclusion and learning within research doing process. This research process helped me to set my new direction towards my mathematical learning, teaching and becoming teacher researcher. I have discussed my learning and conclusion of my research under the following theme;

- Conceptual understanding in mathematics and my transformation
- My paradigm shift
- Multiple realities and my practice
- Reflective practitioner
- Informal mathematics class to formal mathematics class
- My learning and reflection
- Developing conceptual understanding of mathematics
- Citizen mathematics
- Implication to others and myself
- Future direction

Conceptual Understanding in Mathematics and My Transformation

Knowledge without meaningful understanding may not be long lasting. As a student, I had faced some difficulties in mathematics because of meaningfulness. Every time I was searching concepts in mathematical content but did not succeed for every mathematical subject matter. I learned mathematics mostly without concepts and their applicability. My experience says that it is not good approach to learn mathematics without conceptual, critical and reflective knowing. I learned mathematics as a *foreign mathematics* (Luitel, 2003). Experiencing extensions of my example spaces (if sensitively guided) contributes to flexibility of thinking not just within mathematics but perhaps even more generally, and it empowers the appreciation and adoption of new concepts (Watson & Mason, 2005, p. 2). I was getting confident while I was practicing mathematics learning with my own strategy grounded in my experiential world. My experience says that rote memorization may not long-lasting. Repeating the same algorithmic frame time and again was another approach. That approach also did not address my desire, but I did not get its alternative approach when I was in B. Ed. level of study. Just remembering the formulas of mathematics and their application on mathematical problems might not give concepts on mathematical knowledge. That approach could be helpful for procedural knowledge only. My next approach was listening to teachers and note taking for my further preparation. Listening and note taking are cornerstones of classroom success (Kanar, 2011) but not the ultimate solution to understand mathematics in a fullest possible sense.

Sometimes teachers' guidance worked for me. I found many hidden mathematical concepts (unknown concepts for me but they were already established) through teachers' guidance. Mathematical learning occurs through guided discovery,

meaningful application and problem solving as opposed to imitation and blind uses of algorithm (Goldin, 1990). I had constructed some mathematical meanings with the help of my cultural capitals developed by others. Sometime student can adopt other's idea to solve the problems and he/she can sometimes construct their own ideas. Mathematical learning should be viewed both as a process of active individual construction and process of enculturation into the mathematical practices of wider society (Cobb, 1994).

After about 10 years time since I started private tutoring, I came to know about new mathematical teaching and learning process through interaction with student, teacher, teacher educators and literatures available in mathematics education field. During my schooling period, I collected some different ideas through my cultural practices and tried to connect with my academic life. For example, I was well known about geometrical shapes through fishers' net, my playing materials and different designs of buildings and temples. In our culture, we can see more geometrical shapes on temples. After all, I applied those in my academic contexts. Without knowing geometrical shapes, I had constructed shapes of my notebooks. So it's not for schooling purpose only but we may think about its application in our daily life activities. The ethical dimension of mathematical education is to make it accessible to many, but who is going to address this issue (Ernest, 2009)? I started to connect mathematics concepts with my daily life activities afterwards. I am still at the stage of transformation. Perhaps, it is a lifelong process.

Transformation involves higher-order thinking including critical reflective thinking, metaphoric reasoning, dialectical thinking, mindfulness, spiritual awareness, poetic thinking, envisioning (Taylor, 2012). Thus I am trying to become a critically

aware educator, an advocate for citizen mathematics, a poet for heart-based teaching, a humble person to myself. How long does it take to this making of myself?

My Paradigm Shift?

After joining M.Ed. at KU, I learned many more things on mathematics education which helped me to shift my learning, teaching and researching paradigm. This paradigm shift is gaining momentum as a result of emergent theories of mind and society that are giving rise to empowering social epistemologies of teaching and learning (Taylor, 2012). During the time when I was in my B. Ed. and part of my first M. Ed, I was guided by absolutist view of mathematics (Ernest, 1991). I started to think critically. Thinking critically and reading are lifelong learning skills (Kanar, 2011). My journey started from there (and probably from here). I was thinking about different influential factors for my mathematical learning journey before. But within this research process, I came to know about other consensus things in teaching and learning mathematics. “Consciousness is everything” (Sunkar, 2006). Without heightened consciousness, students may not be able to develop the application side of mathematics. When can I make them conceptual knowers? When will they be reflective knowers? When will they be critical knowers? When will they become creative knowers? Above all, when will I become a conceptual, reflective, critical and creative knower?

As A Reflective Practitioner

Research in Mathematics Pedagogy course made me a reflective practitioner. At first, Dr. Luitel told me that I better read some papers on critical mathematics education. Then I went through Kincheloe, Tobin, Skovsmose and Jaworski and I came to understand my traditional understanding of mathematics education. I started to reflect my teaching and learning practices and imagine my selfhood as a

transformative mathematics teacher in my teaching and research career. Critical selfhood is to conceptualize new ways of analyzing experiences and apply it to the reconstruction of selfhood (Kincheloe, 2003). While I was teaching mathematics to primary level student, I would teach them through storytelling, poem writing, drama and reflection writing approach. After looking into their stories, poem and reflection in mathematical concept, I would change my strategies if they needed. Critical selfhood helps to discern the productive power of relationship in the (re)construction of self (Kincheloe, 2003) and thus has helped me to become aware of my limitations (Kincheloe, 2003).

Once I was teaching fraction for the 4^{th} grade students, I asked them to write a poem about fraction. There were 40 students in each class and maximum number of students wrote poem within 45 minutes class. Poems were collected. I went through all and found some lack of content knowledge. Next day I told them to draw different figures that represent different parts and equivalent fraction also. Some of the student made very good pictorial representation of fractional concepts. That time I was reflecting on my previous practice pondering upon whether my students got concept of fraction or not. If I found them lacking concepts, then I would teach them changing another approach. I was also doing the same in mathematics club at the school where I was teaching. I was an in-charge of mathematics club in that school. I made plane for whole year activity for different level students. The member students of mathematics club were from grade four to nine and it was very challenging task for me to manage them according to their interest and grade level. Within process of doing activity, I would correct the ways I planned. Slowly, I was feeling comfortable with my strategies and with student's achievement in mathematics club. Reflective practice made me more comfortable in delivering mathematical concepts.

Another challenge of my reflective journey was to become a fair teacher for all students. If students feel unfair treatment in teaching learning process, then their mathematical interest may divert. And, critical mathematics educators across the world voice concern about the perceive lack of connection between school mathematics and students' lives, leading to lack of interest and alienation. They challenge the notion of mathematics and mathematics education as being morally and politically neutral (Ernest, et al, 2009). Students might start to search their personal identity within classroom. It was another challenge for me. Vygotskian theory of the development of mind, personal identity, language and knowledge, can be represented in a cycle of appropriation, transformation, publication, conventionalization (Ernest, 2010). So, continuous conversation with students, appreciation for their work and display in chart paper were my approaches for addressing them. And for so called weak student, I would start from easy task so that they could feel mathematics easy and make a positive attitude towards it.

Informal Mathematics Class to Formal Mathematics Class

I was teaching home tuition for three years. I got a number of ideas to teach students from traditional way of teaching mathematics. That time I did not care about my professional identity because I was teaching mathematics for my earning purpose only. Just fulfilling my desire was my destination of teaching mathematics. After a long period of time, I became formal mathematics teacher in school. Teaching home tuition and school students in a school classroom are different tasks. There is more responsibility in school teaching rather than in the home tuition. Students can feel more confident in school achievement rather than in home tuition class. Thus school might help to develop students' confidence level and leadership skill in mathematics. Effective transition to school is a valuable contributor to children's sense of

confidence in the school setting and to improving children's academic outcomes. However, traditional understandings of school entry have focused on children's readiness as a set of normative characteristics rather than on the shared processes that support the change experience of children and families (Petriwskyj & Grieshaber, 2011).

As a school mathematics teacher, I have experienced that language also can play important role in developing mathematical knowing. I have found problem in understanding mathematical notions. Students might feel quite difficult in understanding word problems. But if students know earlier, then they can perform faster. In addition, early mathematics knowledge, such as concepts of number and shape as well as logical problem-solving skills help children take advantage of later instruction in basic operations (NRC 2001, 2009). Finally, language (particularly vocabulary) enables children to make sense of instruction in literacy and mathematics, as well as to share and receive feedback on their own ideas (Catts and Kahmi as cited in Hindmanet. al. 2010). So I feel that formal teaching is more professional than informal teaching.

Multiple Realities and My Practice

I always tried to search for alternative solutions through students while I was teaching. As a teacher, I started to believe in a multi-way solution of every mathematical problem even while I was a novice teacher. Once, one of the secondary mathematics teachers came to ask me about the teaching process of volume of prism. I had seen the solution in 'his hand'. Then I told him different practical approaches about its teaching. First of all, I made one cube and made three different prisms which were fitted with same cube. Then I started to show process by using volume of cube V = base area multiplied by its height. After that I broke it and showed it to that teacher.

He was happy to see it. Then he usually started to ask me about different solutions. Every time I would look for alternative ways of solutions.

Within this research writing process, I have become stronger on my beliefs about realities, for there is a continuum of realities – real, unreal, actual, felt and so on. If teacher holds power to produce multi-mathematical realities, then they are empowered to reconstruct their own consciousness (Kincheloe, 2003). I always thought that there might be another solution for every mathematics problem. Students can write from their own way if it is justifiable or if they can justify. Through this autoethnographic research writing process, I have become stronger on exploring my subjective and embodied reality. I think we (teacher, learner and researcher) should develop an ability to hold for a while that the wrong mathematics today can turn out to be a mainstream mathematics in the future. Who knows, there may be many little Lobachevski in our classroom?

My Learning and Reflection

In this autoethnographic research, I have reflected on my journey from childhood to till now. I have shaped my narratives and different images with a stream of memory of my past life. Those narratives offer me ways for my future because I came to know about my weakness and strengths through my reflective writing. Due to continuous guidance of my supervisor, insights gained from different learning theories and my personal desire made me reflective practitioner and constructivist teacher later. Constructivists propose that people create their own meaning and understanding combining what they already know and believe to true with new experiences with which they are confronted (Richardson, 1997). Constructivism leads to new beliefs about excellence in teaching and learning and about the role of both teachers and students in a process. In constructivist classroom, students are active

rather than passive; teachers are facilitators of learning rather than transmitters of knowledge (Stein et. al.1994, p.26). In learning process also, I started to think from different ways. I started connecting my mathematical knowledge with my own context and I always wanted to relate my mathematical knowledge with my local mathematical context. Perhaps, this is a lifelong project for me.

The beauty of mathematics is in meaning. Without its social meaning, it might be a set of muted symbols. So we teacher/ teacher educator need to think about it. While doing this research, I came to know about this dimension of criticality. Critical research might reject the positivistic perspective of rationality, objectivity and truth. Critical social science promotes self-reflection which results in attitudinal change (Kincheloe, 2001). When I started thinking about research, it seemed to me that any teacher is constantly engaged in research. Anything that I do, if I try to learn more from it, that's research. It's just that what we're trying to do here is more formalized research. (Jaworski, 1998). I hope to have made my research tellingly close to me because I have presented some conversations, dialogues, narratives and stories from my inner heart (Eisner, 2008). The urge to search for my identity in terms of what I have done and what I can do has increased. By writing an autobiography of mathematical experiences, I have begun to recognize who I am becoming in relation to mathematics. The act of writing is not an inherently libratory process, nor does it always ensure learning. The very much strong point is that after deciding to do these types of research and till now I found myself in an academic field, I found my space in this world and I found light for my dark way.

Developing Understanding of Mathematics

With the help of this research, I came to know about some influential factors and facets of my multi-perspectival learning and teaching mathematics. Perhaps, poor

economic status, student's personal beliefs and attitude towards learning, ethnic groups of society, teacher's beliefs, school managers, text book, teacher training programme, family structure and supports, etc were my influential factors of conceptual mathematical learning and teaching process. Those factors and facets of human life influenced me in different conditions. Even within that condition we may manage, but I did not get chance to understand mathematics conceptually.

Reflecting upon my role as a teacher, I would teach my students from traditional method of teaching. My school was considered to be a good school for middle class family where the maximum numbers of students of our school were from middle class family. Many middle class families expected high achievement from their children at school. Since our context is little bit different as we always try to do best form our side, but we cannot meet the expectation of our students' parents. As a novice teacher, I felt very difficult to teach my student and I always tried to know and read my students' behaviors and interests. I was afraid of my teaching and I, therefore, would reflect my all the classes. That time I was too much panicking about my failure performance. I would think about my poor classroom performance despite my good plan prepared prior to teaching in the classroom. I consulted with many teachers who were teaching mathematics. In my internship program, I did different work like 'Winter Math Camp', and from that experience I transformed into play-way method in mathematics teaching. That internship program was my transformation period because I realized about the conceptual understanding of mathematics and how it might be possible to give contextual and conceptual understanding towards different mathematical topics. That time I used many examples from our daily life activities and also learned how to link mathematics with our context. That program was very much interesting.

It was a good opportunity for me to improve myself as an academician and as teacher. I spent most of my time on internet and books during that period. Since then, I understood teaching profession is not a joke but it's a challenging and responsible job. If we want to be a good teacher, we need to give more time for profession; we need to think more about our student and their future. We are those who took teaching profession as a survival job only, those who think their idea is ultimate, those who are teaching books and mathematical contents on student, those who beat student do not try to touch students' interest and emotional feeling. These are my major questions and for the solution, I learned something from that winter mathematics camp. Now I feel that transformation is necessary for me and I will try to do something for my students as per their interest. From that camp, I learned that most of the students want to learn mathematics through games and activities. Finally, I hope game play methods in mathematics teaching could be very much helpful to minimize mathematics anxiety among students.

Citizen Mathematics

Our life worlds are connected, so everything comes together. Perhaps, we may not separate mathematics from other subjects and day-to-day activities. Thus far, our mathematics education focused on providing mathematical knowledge as a separated and alienated discipline. Our school mathematics needs a vision that concerns with mathematical literary that can also provide skills necessary for local and global citizenship, for we need to develop skills and abilities to perform a two-way border crossing. Thus, I would like to subscribe to the view of citizen mathematics for my future practice and that as a public educator I would prefer this mathematics to promote social democratic ideals (Swetz, as cited in Nikolakaki, 2011, p.1).A citizen

with civic senses needs mathematics because many decisions that directly affect our lives.

In my inquiry, I have presented some decontextualised mathematical practices. How can I transform these practices to "citizen mathematics"? In what ways can this "citizen mathematics" facilitate the promotion of education all? These are key questions to be addressed for my future inquiry.

Implication to Others And Myself

Before learning any documents on autoethnographic research, I was thinking about its quality standards. Once I questioned Dr. Luitel about quality standards of his research. After that I started to think about others' practices. I was naively thinking, how personal stories become educational research. After few months, I came to know about it by the help of my supervisor. At first I was planning to do ethnographic study, but after few months I decided to do this type of research. I was worried about my English. Actually my speaking and writing English was not good. I don't know how my friends and teachers got me but I was not sure at first. When I heard about reflective practice, then I started to reflect myself on my practice. I started to search for my 'self' in academic field, I started to ask question about myself. Then with the continuous support and suggestion of Dr. Luitel, I made my heart open for autoethnographic research, for it is heart that matters in this transformative process. Because of my English language skill and less exposure on theoretical dimensions, this research took around one year. But finally, I came to reflect upon myself through this research. I made my confidence level higher than before. Thus this research might be very much helpful for those students who have inferiority complex.

This research might be helpful for those teachers who are still teaching mathematics without multi-perspectival sensibilities. This research might strike them

about their practices once. Students also think about reducing influential factors for conceptual and other meaning making processes. This research also might be helpful for those parents who have different beliefs towards their children's achievement. This research also might be very much helpful for textbook writers who are writing mathematics textbook without concepts of mathematical problems. This research could also help those people who seek to involve in similar types of research teaching and learning for their pedagogical thoughtfulness in conceptual mathematics teaching and learning process. But I do not have anything to claim at this stage apart from me becoming aware of my own limitations.

Future Directions

After articulating my story and narratives, I came to know about the gap between our theory of learning and our practice. My journey shows my own up and down nature in learning mathematics. Different influential factors influenced me for different ways. This critical project made my direction. Critical mathematics education is now becoming widely discussed issue. Critical mathematics education is not to be understood as a special branch of mathematics education. It cannot be identified with a certain classroom methodology, nor can it be constituted by a specific curriculum. Instead, I see critical mathematics education as characterized through concerns emerging from the critical nature of mathematics education. These concerns have to do with both research and practice (Skovsmose, 2004). As a critical teacher researcher, I will try to develop conceptual mathematics teaching process in my class. From now I will try to articulate my experience as a part of my reflecting journey of mathematics teacher, student and a novice researcher.

Before conducting this research, I was excited to do something for activity-based curriculum for Nepalese primary school mathematics. In teaching, I am still

excited in activity-based teaching. In activity-based teaching, there may be storytelling, poem writing, drama, physical games, drawing and painting, etc. Nepal is developing country and our educational quality needs to develop. Because of lack of resources, we are unable to teach activity-based mathematics curriculum prescribed course content. There is no more change since my schooling time to the schooling till now. So I would like to contribute for that in my future. I would like to do something as a critical teacher researcher. I have a dream to contribute in an activity-based mathematics teaching so that students can get concept easily and without feeling any anxiety. The dream is a way of knowing, and it stimulates responses and attempts to understand it that collaborates with other modes of cognition (McNiff, 2008). Because of lack of vision and resource, I couldn't get conceptual learning environment in school mathematics. So I will continue to conduct research in mathematics education in my future endeavor. Mathematics must be reflected on and criticized in its variety of forms of action (Skovsmose, 2004). So I will try to reflect my practice from different perspectives. This research gave me more confidence on doing educational research in my future study also. If I will be able to afford for further study, then I will do again narrative type research because this narrative helps me to examine my own practices.

REFERENCES

Anthony, G. & Walshaw, M. (2009). *Effective pedagogy in mathematics.* The International Academy of Education. UNESCO.

Ayers, W. (1993). *To teach the journey of a teacher*. Teachers College Press. New York.

Belbase, S. (2006). *My journey of learning and teaching mathematics from traditionalism to constructivism: A portrayal of pedagogical metamorphosis*. Unpublished dissertation. Kathmandu University, Nepal.

Bentz, V. M. & Shapiro, J. J. (1998). *A mindful inquiry in social research*. Sage, Thousand Oaks.

Blevins-Knab, B. & Musin-Miller, L. (1996). Number use at home by children and their parents and its relationship to early mathematical performance. *Early development and parenting*. 5, 35-45.

Bronner, S.E. &Kellner, D. M. (1989). *Critical theory and a reader society.* Rutledge, London.

Cohen, L., Manion, L. & Morrison, K. (2002). *Research methods in education* (5th ed.). Routledge Falmer. London.

Cole, A.L. & Knowles, J.G. (2008). *Arts-informed research*. Handbook of art in qualitative research: Perspectives, Methodologies, Examples, and Issues. Sage publication. The Netherland.

Cruickshank, D. R. (1999). (Ed.).*The act of teaching*. McGraw-Hill College. New York.

D'Ambrosio, U. (1985). *Ethnomathematics and its place in the history and pedagogy of mathematics.* For the Learning of Mathematics, 5(1), 44-48.

D'Ambrosio, U. (1990). *Etnomatematica [Ethnomathematics]*.Sao Paulo: EditoraAtica

D'Ambrosio, U. (1998). *Ethnomathematics: The art or technique of explaining and knowing* (P. B. Scott, Trans.). Las Cruces: ISGEm. (Original work published in 1990).

D'Ambrosio, U. (2006). The program ethnomathematics: A theoretical basis of the dynamics of inta-cultural encounters. *The Journal of Mathematics and Culture., 1* (1).

Daszko,M.&S Cook, P.F. (1998). Teachers' reflection in learner centered education. *Journal for education reform in namibia*, Namibia

Denzin, N.K. & Lincoln Y.S. (Eds.). (2005). The discipline and practice of qualitative research. In N.Denzin & Y. Lincoln. *Handbook of qualitative research.* 01-32. Sage Publication.

Dewey, J,(1963). *Experience and education*.macmillian publishing company. New York.

Dorfler, W.(2006).Inscriptions as objects of mathematical activities. In Maasz, J. & Schoeglmann, W. *New mathematics education research and practice*. (97-11). Sense Publishers.

Eisner, E. (2008). Art and knowledge. In Knowles, J.G. & Cole, A. L. *Handbook of art in qualitative research: Perspectives, Methodologies, Examples, and Issues*. Sage Publication.

Ernest, P. (1991). *The philosophy of mathematics education*. Falmer Press, New York.

Ernest, P. (1996). *Is mathematics discovered or invented?* University of Exeter. United Kindom.

Ernest, P.(2001). *What is the philosophy of mathematics education*? University of Exeter, United Kindom.

Ernest, P., Greer, B. & Sriraman, B. (2009). *Social justice in, and through, mathematics education.* Critical issue in mathematics education. Information age publishing inc. The Montana council of teachers of mathematics. USA.

Fleener, J. M. (2004). Why mathematics? Insights from poststructural topologies. *Cambridge Journal of Education, 35*(1), 69-87. Gotebord University, Sweden.

Flick, U. (2006). *An Introduction to Qualitative Research*. Sage Publications Ltd.

Frankenstein, M.(1998). *Reading the world with mathematics: Goal for a critical mathematical literacy curriculum*. Network of Educators on the Americas. Washington, DC.

Glasersfeld, E.V. (1983). *Learning as a Constructive Activity, in Bergeron and Herscovics,* 1, 41–69.

Guba, E. G. & Lincoln, Y. S. (1989). *Fourth generation evaluation*. Sage Publications.

Gurung, S. (2011).*Looking back on my personal journey of learning English: An autoethnographic portrait.* Unpublished dissertation. Kathmandu University, Nepal.

Heinberg, S. (2005).Only leader with new knowledge can lead the transformation. *The Leader's Handbook*, McGraw Hill, New York.

Hersh, R.(1997). *What is mathematics really*. Oxford University Press. New York http://plato.stanford.edu/archives/spr2012/entries/critical-theory.

Jaworski, B. (1998). Mathematics Teacher Research: Process, Practice and The Development of Teaching. *Journal of Mathematics Teacher Education, 1*, 3-31. Kluwer academic.

Jin,M., Feng,X., Liu,J.,Dai, feng.(2010). Comparison study on high school students' mathematics belief systems between han and chasxian nationality. *Journal of mathematics education, 3*(1), 38-151.

Kamens, D. &. Benavot, A. (1992). "A Comparative and Historical analysis of Mathematics and Science curricula 1800- 1986", in J. Meyers, D. Kamens & A. Benavot : *School knowledge for the masses: World models and National Primary Curricular categories in the 20th century*, Falmer Press, London

Keitel, C. (2009). *Mathematics, Knowledge and Political power*. Sense Publishers. The Netherlands:

Kincheloe, J. L. (2008). *Knowledge and Critical Pedagogy: An intoduction*. Springer Science + Business Media B.V. Canada.

Kincheloe, J. L. (2009). *Teacher as Researchers: QualitativeInquiry as a Path to Empowerment*. The falmer press. London,

Kincheloe, J. L.(2003). Critical ontology: vision of selfhood and curriculum. *Journal of curriculum theorizing. 19* (1). 47-64.

Kincheloe, J.L.(2010). *Knowledge and critical pedagogy*. Dodrecht, The Netherlands: Springer

Kothary, C. R. (2008).(Ed.). *Research methodology, methods and techniques*. New Age International Publication (P) Ltd. New Delhi.

Kunkar, K. (2009). *Looking back on my personal journey of learning english: an autoethnographic portrait*. Unpublished dissertation. Kathmandu University, Nepal.

Lamichhane, S. P. & Wagle, M. P. (2008). Post- modernism and Nepal's education. *Journal of Edecation and Research, 1*, 9-12, Kathmandu University, Nepal.

Lax, A. (1999). *Contemporary issues in mathematics education*. New Orleans: Mathematical Sciences Research Institute Publication.

Leont'ev, A.N. (1981). The problem of activity in psychology. in J.wertch (Ed.). *The concept of activity in soviet psychology*. M.E.Sharpe. U.S.

Lerman, S.(2009). Cultural Psychology, Anthropology and Sociology. In J. Maasz & W. Schloeglmann. *New mathematics education research and practice*. 171-188. Sense Publisher. The Netherlands.

Luitel, B. C. (2009). *Culture, Worldview and Transformative Philosophy of Mathematics Education in Nepal: A Cultural-Philosophical Inquiry*. An unpublished dissertation. Curtin University of Technology.

Luitel, B. C. and Taylor, P. C. (2003). *Critiquing situatedness: An instegrated approach to improving a researcher's practice*.Proceedings Western Australian Institute for Educational Research Forum 2003. Retrieved from http://www.waier.org.au/forums/2003/luitel.html

Luitel, B. C. & Taylor, P. C. (2006). Envisioning transition towards a critical mathematics education: A Nepali educator's autoethnographic perspective. In J. Earnest & D. F. Treagust (Eds.*), Educational Change and Reconstruction in Societies in Transition: International Perspectives*. 91-110. Sense Publishers The Netherlands.

Luitel, B. C., & Taylor, P. C. (2007). The shanai, the pseudosphere and other imaginings: Envisioning culturally contextualized mathematics education. *Cultural Studies of Science Education 2*(3), 621-638.

Luitel, B. C.; Taylor, P. C. & Mphil Student of KU. (2012). *Mathematics education research as/ for teacher professional development: transforming the heart, mind and soul of mathematics education.* Unpublished paper, ICME, Korea.

Luitel, B.C.(2007). Storing, critical reflectivity and imagination: transformative approach to research as/for culturally contextualised professional development. In P. C. Taylor & J. Wallace (Eds). *Contemporary qualitative research: Exemplars of science and mathematics education*. 217-228. Springer.

Luitel,B.C, &Taylor, P.C.(2005), *Overcoming culturally dislocated curricula in a transitional society: An autoethnographic journey towards pragmatic wisdom.* American educational research association.

Maasz, J. & Schoeglmann, W. (2006). *New mathematics education research and practice*. Sense Publishers. The Netherlands.

Maier, H.(2006). Mathematics learning as a cognitive process. In Maasz, J. & Schoeglmann, W. *New mathematics education research and practice*. 95-96. Sense Publishers.

Maude, S.P., Brotherson, M. J., Summers, J.A., Erwin, E.J., Palmer, S. & Peck, N.F., et al. (2011). Performance: A strategy for professional development in early childhood teacher preparation. *Journal of early childhood teacher education. 32*(4), 355-366.

McNiff, S. (2008). Art-based research. In Knowles, J.G. & Cole, A. L. *Handbook of art in qualitative research: Perspectives, Methodologies, Examples, and Issues*. Sage Publication.

Meson, M.(2000). Teachers a critical mediators of knowledge. *Journal of philosophy of education society of great Britain. 34*(2). Blackwell publishers. USA.

Mesquita, M.(2009). Mathematics Education: For whom? In Ernest, P., Greer, B. & Sriraman, B. *Critical issue in mathematics education*. Information age publishing inc. The Montana council of teachers of mathematics. USA.

Mezirow, J. (2009). (Ed.). Transformative learning in practice. In Mezirow, J., & Taylor, E. W. *Transformative learning in practice: insights from community, workplace, and higher education*. John Wiley & Sons. New York.

Nikolakaki, M. (2011).*Investigating critical routes: the politics of mathematics education and citizenship in capitalism.*University of Peloponnese.

Niss, M.(2006). The structure of mathematics and its influence on the learning process. In Maasz, J. & Schoeglmann, W. *New mathematics education research and practice.* (51-62). Sense publishers.

Olatunde,Y.P.(2009), Relationship between teachers' attitude and students' academic achievement in mathematics in some selected senior secondary school in southwestern Nigeria. *European Journal of Social Sciences,11*(3).

Olkun, S. & Toluk, Z. (1998). *Text book, word problems and student success on addition and subtraction*. AbantIzzet Baysal University, Turkey

Otte, M. (2006). Learning difficulties resulting from the nature of modern mathematics: The problem of explanation. In Maasz, J. & Schoeglmann, W. *New mathematics education research and practice*. 73-94. Sense publishers.

Pandey, T. R. (2010). *Paradigm shift in terms of applying participatory pedagogies in teaching of mathematic in Nepal*. Unpublished dissertation. Kathmandu University. Kathmandu

Paudel, K. P. (2008). *Tharu culture: An ethnographical prospective*. Unpublished dissertation. Kathmandu University, Nepal

Pokhrel, T.R. (2011). *Critical thinking practices in mathematics classroom in Nepal*. Unpublished dissertation. Kathmandu University, Nepal

Poudel, A.B.(2010). *Exploring mathematics in motherly nature: An autoethnographic inquiry*. Unpublished dissertation. Kathmandu University, Nepal

Prabhakaram, K. S. (1998). *Concept attainment model in mathematics teaching*. Discovery Publishing House, New Delhi.

Quale, A. (2006). *Radical Constructivism, and the Sin of Relativism*. Retrieved from http://www.ihpst2005.leeds.ac.uk/papers/Quale.pdf.

Quicke, J. (2010). Narrative strategies in educational research: Reflection on critical autoethnography. *Educational Action research, 18*(2). 16-30

Richard, M. F. & Rebecca, B. (2003). Random thought: Learning by doing. *Chemical Engineering Education, 37*(4), 282–283. Retrieved from: http://www.ncsu.edu/effective_teaching.

Richardson, V. (2003), *Constructivist pedagogy,* Teachers college Columbia University.5: 1623-1640, Columbia.

Roth, W.-M. (2005). *Auto/Biography and Auto/Ethnography: Praxis of Research Method.* Sense Publishers. The Netherlands.

Runesson, U. (2005). *Variation: Critical Aspect of Teaching and Learning Mathematics.* VA: National Council of Teachers of Mathematics. Reston.

Sam,L.C.(1999). *Public image of mathematics*. University of Exeter.

Scheneider, J.H.(2000), Dewey in France. *Studies in Philosophy and Education.* 19: 69–82. Kluwer Academic Publishers, Netherlands.

Schweiger, F.(2006). Fundamental ideas. In Maasz, J.& Schoeglmann, W. *New mathematics education research and practice.(*63-72). Sense Publishers. The Netherlands.

Shrestha, I.M. (2011). *My journey of learning and teaching: A trans/formation from culturally decontextualised to contextualised mathematics education.* Unpublished dissertation. Kathmandu University.

Siegler, R.S.(2009). *Improving the numerical understanding of children from low income families.* Department of Psychology. Carnegie Mellon University. Pittsburgh.U.S.

Sierpinska, A., & Lerman, S. (1996). Epistemologies of mathematics and of mathematics education. In A. J. Bishop et al. (Eds.), *International Handbook of Mathematics Education.* 4, 827–876. Kluwer Academic Publishers. Netherlands.

Skovsmose, O. (2009). *Mathematics, Culture and Society*.The Netherlands: Sense Publishers.

Spry, T. (2006). A performative-I copresence: Embodying the ethnographic turn. In Tayler. P.C.(2008). *Cultural Auto/ethnographic Research as/for Transformative Professional development*. Curtin University of Technology, Australia.

Star, R.P. (2005). *Constructivist practices: Middle and secondary school science teachers.* Univerity of Cincinnati.

Talbert, J.E. (2000). Professionalism and politics in high school teaching reform. *Journal of educational change*. Kluwer Academic Publishers. Netherlands.

Taylor, P. C. (2012). Transformative research for meaning-centered professional development. In O. Kovbasyuk& P. Blessinger (Eds). *Meaning-centered*

education: International prospective and exploration in higher education. Routledge, New York.

Taylor, P. C. Settelmaier, E., & Luitel, B. C. (2012). Multi-Paradigmatic transformative research as/for teacher education: An integral perspective. In K. Tobin, B. Fraser & C. McRobbie (Eds.), *Second international handbook of science education*.373-388. Springer, The Netherlands.

Taylor, P.C. (1996). Mythmaking and mythbreaking in mathematics classroom. *Educational studies in mathematics*. *31*(2), 151-173. Kluwer Academic Publishers, Netherland.

Tobin, K. (1999). *Teacher as Researcher and Researcher as teachers, Research in Science Education*. 29(1),1-3. University of Pennsylvanla.

UNESCO (2008), *Developing culturally contextualised mathematics resource materials: capturing local practices of tamang and gopali communities*, UNESCO, Kathmandu

Upadhyaya, D. P. (2007). In D. P. Upadhyaya, *New Trends in Mathematics Education.* Vidyarthi Prakashan (P) Ltd. Kathmandu, Nepal.

Van Manen, M. (1990). *Researching lived experiences: Human science for an action sensitive pedagogy.* The State University of New York, London

Wallace, P. C. (Ed.), (2006). *Contemporary Qualitative Research: Exemplars for Science and Mathematics Educators*. Kluwer Academic Publishers. Netherland.

Walshaw (Ed.), Mathematics education within the postmodern. *Information Age*. 201-218. CT: IAP, Greenwich.

Wedge, T.(1999), To know: Mathematics, that is question of context, teaching and learning mathematics in context. *Educational studies in mathematics*, *39* (1-3). 205-227. retrieved from http://www.jstor.org/stable/3483168.