MY JOURNEY OF LEARNING AND TEACHING:

A TRANS/FORMATION FROM CULTURALLY DECONTEXTUALISED TO

CONTEXTUALISED MATHEMATICS EDUCATION

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A Dissertation

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DECLARATION

To the best of my knowledge belief this dissertation contains no material which has been accepted or produced for the award of any other degree in any University.

_____   December 30, 2011

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APPROVAL

Dissertation of Master of Education in Mathematics has been submitted by Mr. Indra Mani Shrestha, presented on the research committee on December 30, 2011 and

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

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Om Namo Shivayah!

श्रीभगवानुवाच
अभयं सत्त्वसंशुद्धिर्ज्ञानयोगव्यवस्थितिः ।
दानं दमश्च यज्ञश्च स्वाध्यायस्तप आर्जवम् ॥१॥
अहिंसा सत्यमक्रोधस्त्यागः शान्तिरपैशुनम् ।
दया भूतेष्वलोलुप्त्वं मार्दवं ह्रीरचापलम् ॥२॥
तेजः क्षमा धृतिः शौचमद्रोहो नातिमानिता ।
भवन्ति सम्पदं दैवीमभिजातस्य भारत ॥३॥

Trans: The Supreme Personality of Godhead said: Fearless; purification of one's existence; cultivation of spiritual knowledge; charity; self-control; performance of sacrifice; study of the Vedas; austerity; simplicity; nonviolence; truthfulness; freedom from anger; renunciation; tranquility; aversion to faultfinding; compassion for all living entities; freedom from covetousness; gentleness; modesty; steady determination; vigor; forgiveness; fortitude; cleanliness; and freedom from envy and from the passion for honor-these transcendental qualities, O son of Bharata, belong to godly men endowed with divine nature.– Bhagawat Gita

DEDICATION

To all known and unknown teachers, gurus, philosophers, authors who imparted immense knowledge and wisdoms on me in this life time,

To my late father Mr. Dilli Man Shrestha who always stood up for my education and because of whom I am here at this brighter phase of educational life,

To my beloved mom in the world whose love and affection has greatly supported me in surviving and living my life healthier and the better way,

To my wife Manita whose continuous love, care, inspiration and support encouraged me heavily to work continuously throughout many awkward days and nights to complete this research study,

To my son Apurva and daughter Atithi who are the future of the nation.

ACKNOWLEDGEMENTS

AN ABSTRACT OF THE DISSERTATION OF

Indra Mani Shrestha for the Degree of *Master of Education in Mathematics* presented on December 30, 2011.

Title: *My Journey of Learning and Teaching: A Trans/formation from Culturally Decontextualised to Contextualised Mathematics Education*

Abstract Approved……………………………

Dr. Bal Chandra Luitel

Dissertation Supervisor

ABSTRACT

This dissertation portrays my comprehensive and evolving inquiry into the prolonged problems of culturally decontextualised mathematics education encountered by the students of Nepal in schools and colleges. It also depicts how the pupils from the land of diverse cultures are deprived of learning contextualised (culturally embedded) mathematics. I have presented comprehensively my learning practice of mathematics in school, colleges and University, teaching practice of mathematics in secondary school and trainings I have given to primary school teachers based upon the Habermas' three fundamental human interests-technical (controlling), practical (understanding) and emancipatory (independence).

To portray my research study, I have chosen an *autoethnography, small p philosophical inquiry* and *Living Educational Theory* as my methodological referents comprising narratives such as poems, drama, dialogues and stories visualizing them with interconnected photographs so far. Autoethnography helped me produce the research

texts of my cultural and professional contexts of learning and teaching mathematics. Small p philosophical inquiry enabled me to generate new knowledge via a host of innovative epistemologies that have the goal of deepening understanding of normal educational practices by examining them critically, identifying underpinning assumptions, and reconstructing them through scholarly interpretations and envisioning. And living educational theory enabled me to inquire lived and living contradictions of our lifeworlds. In order to carry out my ontological (what is reality?) and epistemological (to know reality) activities I have used the paradigms of interpretivism (Habermasian practical interest) and criticalism (Habermasian emancipatory interest).

The paradigm of interpretivism helped me in interpreting/explaining the teaching-learning practice of culturally decontextualised mathematics embedded in events or situations of my life. 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 culturally decontextualised to contextualised mathematics education. I also depicted how inclusion of ethnomathematics in academic mathematics helps pupils in understanding (practical) the culturally decontextualised (pure?) mathematics in sharing of knowledge through co-operative learning in an independent environment (emancipatory) rather than in controlled environment (technical). I also portrayed how an inclusion of contextual mathematics in Nepali curriculum prevents pupils from diversion/rejection of academic mathematics as a body of pure knowledge.

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Indra Mani Shrestha, Degree Candidate   December 30, 2011

TABLE OF CONTENTS

ABBREVIATIONS

A. D.	Anno Domini
B. Ed.	Bachelor of Education
B. Sc.	Bachelor of Science
I. Sc.	Intermediate of Science
KU	Kathmandu University
M. Ed.	Master of Education
M. Phil.	Master of Philosophy
M. Sc.	Master of Science
Ph. D.	Doctor of Philosophy
SLC	School Leaving Certificate
TU	Tribhuvan University
UNESCO	United Nation Educational, Scientific and Cultural Organization

PROLOGUE

My Brief Journey of Education

My Journey of Learning

Born as a first child in a nuclear family in the

village of Maheswor Jhoda (now Sundarpur -5),

Morang, Nepal in 1970 A. D. my early childhood

passes with a very difficult time as I usually fall

ill. The first child as a son had brought so many happiness in my family that my father

was always there by my side to fulfill my demands.

When I was just a month old, my life was almost

shattered by a disease. Later, my health started

recuperating gradually and became healthy enough

to walk around and run hither and thither normally as other children do. Then my

childhood passed joyfully without any interventions in my life.

Now it was time for my admission to a nearby school calledas Jyoti Nimna

Madhyamik Vidyalaya and there was a joy in my family that the first member of the

family has got enrolled to the school nearby. My father was very much excited about

it and with a slate (*Kalo Paati)* and chalk in my hands I

attended my classes in Nursery. My mother always said

that I was very excited to go to school and this very

moment of life is still fresh in my memory.
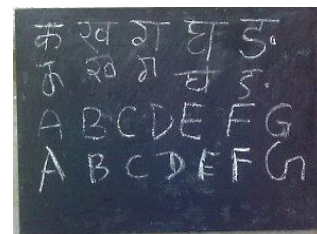
Time passes awayby learning and writing *ka, kha, ga, gha…..*(Nepali

alphabets), *a, b, c, d* and *ek, dui, tin, char,…* (Counting numbers). I have some friends

in the neighbourhood such as Hari, Rudra and Dammar who usually accompanied with my studies at school and home as well. However, my father was very conscious regarding my academic performance and he usually guided me at home even after dinner. He suggested me to rote-memorize *ka, kha, ga, gha…..* and *ek, dui, tin, char,…* In the early classes I could not do well as expected. I was weak at Mathematics such as telling *ek, dui, tin, char,…* and *dui ekan dui, dui duna char,…*(Multiplication Table). Then my father inspired me to better my study by helping me to rote- memorize all those mathematical stuffs. I got a command in memorizing all counting numbers from 1 to 100 and Multiplication table up to 10 when I was just in class 1.

I began to learn preliminary addition and subtraction with the help of fingers, sticks and vertical bars. As far as I can recollect, I learnt the multiplication table by rote-memorization method. However, I have now got a clear idea what multiplication is all about- It is simply a repeated addition.

Although I was not gaining preliminary concepts of mathematics, I gradually became smarter in solving algorithmic mathematics problems easily due to regular practices. But my father had a little bit of hard time to guide me in higher classes. He then had to seek for a mathematics tutor nearby my home for a few months. Since then I became a master in algorithmic problem solving in my class. I started scoring above 90 % marks in mathematics. I could be a favorite student of all teachers, especially to my mathematics teacher. The teacher usually asked me to solve difficult algorithmic problems and suggested other students to learn more from me. Gradually,

I started learning mathematics in group discussion with my friends at home/friend's house. Now I came to know that it was a one-way traffic of learning mathematics from the school teacher. Whatsoever, I learned mathematics gradually and I still remember those happy childhood days when I used to play marbles, *ekal-khutti*, *dandi-biyo*[1] etc. with my friends. I never envisaged how mathematics are linked to all these games (how could I do so as there was no one to guide me). Marbles are spherical balls, *ekal-khutti* is played in a rectangular box in a ground with one foot held up and the other hitting a stone from one box to other. *Dandi-biyo* is our National game and I never tried to link it to a mathematical game. Apart from these, I made some clay models and played with these as *bhanda-kuti*[2]. There was an imagination in playing *bhanda-kuti*-how one runs a home like cooking food, eating and cleaning up the utensils. These all were parts of learning mathematics. All these help children link mathematics to cultures of our society. Mathematics begins from our society (home) and ends up in the society (any). It is like an in-born character of a person who learns mathematics from his/her surroundings (home) and discovers new theories of mathematics which later may become a headache for learners when these theories are not contextualised.

In fact, I claim that mathematics is learnt in the process of growth in the diverse cultures of society. Zaslavsky (1971) states that if we think of mathematics as the development of structures and systems of ideas involving number, pattern, logic, and spatial configuration and then examine how mathematics arises and is used in various cultures; we can gain a much deeper understanding of mathematics. Then, once a beginner gets involved into mathematics with full concept, he/she enjoys

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[1] Locally played games
[2] Generally perceived to be a girly game, Bhanda-kutti is about a play about cooking and distributing the cooked foods.

mathematics and can better solve axiom, postulates and theorems. But our preliminary learning of mathematics is all about rote memorization/practice. By hook or crook, one should get higher % in mathematics so as to pave a path for admission in science and technology in higher education. Because of this, the real flavor of mathematics has faded away and there is a fear on the mind's pupils about mathematics. That's why; mathematics was a *difficult* subject for me, many others and Luitel (2003) as he asserts that mathematics for him was a *foreign* subject in his early (school) education.

When I was in class 6, I bagged the second position. The first boy was not smarter than me in mathematics. It was a bitter fact for me that I never bagged the first position since then up to Class 10; instead I remained second in my latter part of schooling. My mathematics was encompassed in and around *practice* and I was thoroughly enjoying it. Although I had not got the *contextual* flavor of mathematics, I was smart in school mathematics and was able to get the highest marks than others. Had our teachers taught us linking the mathematics to our cultures, for example, linking mathematics to the practices being done by carpenters, black-smith, potters, etc., I could have got the 'realistic'[3] vision/concept of mathematical shapes easily. If a teacher had inspired us to bring the mathematical materials from our houses/locality, I could have brought so many materials and learnt them as contextual mathematics; and I could have known that mathematics is not only the academic mathematics but also the mathematics that we practice in our everyday life! I agree with what Ernest (1991) has to say that the social constructivist thesis is that mathematics is a social construction, a cultural product, fallible like any other branch of knowledge. But the conventional method of teaching made me think that mathematics was a very difficult subject and had no/less practical aspects in our everyday practices. However, I know

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[3] The idea of realistic mathematics education is a radical response to so-called logical and rigorous mathematics education of the 60s.

that I was smart in academic mathematics because of my own method of learning (practice).

In 1983 A. D. after completing my study up to class seven, I had to walk about a half an hour from my home everyday to the new school called Sajilal Madhyamik Vidyalaya for my secondary education. My education in secondary level also completed in the same way of learning, the conventional teacher-centered method. The teachers used to enforce the students for practicing the problems of mathematics several times targeting the examinations.

After the SLC, I completed my Intermediate (I. Sc.) and Bachelor (B. Sc.) levels in chaos from Tribhuvan University. There were merely a two-way communication between students and teachers; there were no classroom discussion; rather I studied in my own way of rote-learning and practice method and group study with friends. I had no idea, how Mean Value Theorem of Derivatives, Group Theory of Algebra, etc. are contextualised and why I am learning all these bodies of pure knowledge.

I did not learn mathematics contextually; rather I learnt it for the preparation of exams. I didn't know how we construct the knowledge of mathematics. Here I should not be blaming my respected teachers for the way they had taught me, because they were guided by the pre-determined decontextualised documentation called curriculum. I stress on reform of curriculum. It should be upgraded/changed as per pupils' interests/cultures. I usually had open discussion with my friends about the curriculum in my college life (Intermediate and Bachelor).

After completing my B. Sc. in 1992 A. D., I enrolled to Tribhuvan University in Kirtipur for my Master of Science in Mathematics. But, due to many economic hurdles in my life, I couldn't do justice to my higher studies. I was compelled to seek a job of a full time mathematics teacher in private English Boarding Schools in the Kathmandu valley. After many years of teaching, I finally got myself enrolled to Kathmandu University for my Master Degree of Education in Mathematics in 2007.

The beginning of my KU life passes with chaos as I was only the beginner of computer applications and the education system here at KU is technology based. Moreover, I was in dilemma whether I could adjust myself with the environment of various philosophies and psychologies of education with which I was completely like an alien. After long years of gap in my academic study, I had joined Kathmandu University; and I feared if I would manage my study. Later on, with my strong determinations and devotions, I could achieve the result which I had never done before in my life. I got grade A in over all subjects in the result of first trimester exams. Was that not a motivation for me? It was true but different experiences in my educational journey as before I was the unlucky student who never grabbed the first position in previous educational journey. Although the educational psychology and learning theories in this post-modern age do not lay much emphasis on what a learner achieve as a certificate/position/marks rather it emphasizes the knowledge acquired or constructed by the learners (which I learnt from KU), being a humane of this so-called competitive society I was honored and excited to deepen my study in various educational theories from books, articles, electronic internet, etc. I enjoyed spending my days and nights in study despite my hectic schedule of teaching in school and private tuitions. In return, I got insights into holistic knowledge of learning and teaching mathematics with the help of various educational theories and practices in

Kathmandu University[4]. I closely understand how mathematics is learnt and taught. The facilitators and educators of KU enlightened my educational life through their cooperative guidance throughout the whole academic years. Here is one poem I have written about the pre- and post-learning of mathematics at Kathmandu University.

Mathematics was a part of my life,

Theorems were to memorize,

Calculations were stepwise,

And my purpose of learning was victimized.

Theorems were in the midst of fog,

So were the Calculus and Log,

Analysis and Algebra were capitalized,

And my purpose of learning was victimized.

I desired to be Newton in Math and tried to be Einstein,

But I found Mathematics as a *Giant*,

And my purpose of learning was victimized.

Now I find it in the patterns of stars in the sky,

And find in the cultures of our society,

Mathematics is not what I thought as anxiety,

It is really my life and property.

Mathematics is the backbone of other subjects,

Science and Technology, and Computers, and so on,

All have their origin at Mathematics,

I am proud to be a part of Mathematics.

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[4] This does not mean that teaching at KU was flawless, for there were some problems about handling students' feedbacks and dealing with students' questions in some courses. Nevertheless, KU offered a radical paradigm of higher education in which there may be some questions and confusions as a result of unpreparedness of some teachers and students.

My Journey of Teaching

Right after I appeared the SLC examinations in 1986 from Sajilal Secondary School, I tasted the first flavor of teaching as tuition classes for class IX students in my village. Since then I got tempted into the teaching field. In the beginning I just taught the students in tuitions and coaching classes. After completing my Bachelor's degree from Tribhuvan University in 1992, I came to Kathmandu for my Master's Degree in Mathematics. But I could not complete it due to my poor economic condition. Then I began teaching in different English Boarding Schools as a professional teacher. Currently, I am a mathematics teacher at United School, Satdobato, Lalitpur serving as a secondary mathematics teacher and as a teacher educator for the last eight years.

As a teacher, I had my own personal philosophy: I should teach the students in such a way that they understand the concepts well on how the mathematical logics and patterns are originated and came to these forms and use them to solve any kind of related unseen problems. I used to motivate them in my own way; *shouting at them or giving some physical punishments*. But after joining Kathmandu University, I came to know that I am completely wrong in my approach to motivate and teach them. I now teach them psychologically using different strategies based on *constructivism* (e. g. cooperative learning) by linking cultural mathematics to academic mathematics in the form of project work, experimentation in Math Lab, etc. For Piaget: constructivism claims that we *always* and *only* learn through constructing (Piaget, 1970). I encourage students to collect purchasing and selling bills to give the concept of profit and loss if their parents are shopkeepers and businesspersons; vouchers and bank statements to give the concept of simple interest if their parents are working in the Banks etc. Some students hesitate to tell their parents' profession such as potters, carpenters, tailors etc. I never make them feel that they are less-valued in the society; rather I encourage

them to bring different models of mathematical shapes from their house. They bring them to the classroom and I explain them linking to academic mathematics.

It is true that my teaching and learning strategies took 180^0 turn when I joined Kathmandu University. The facilitators and educators made me so spellbound that mathematics is not what I was thinking; I was mostly teaching students in the conventional method to prepare them being good marks achievers (students were exam-oriented). My teaching was inspired by the teacher-centered methodology giving lectures to spellbound students as passive recipients. There was lack of systematic strategies (plans) to involve all students actively in interaction in the classroom activities. There was less/no use of teaching materials. After I joined KU, I began to use in my teaching all the ideas, methodologies and techniques of teaching-learning that I have learnt from K.U. I also teach them how the mathematical knowledge is constructed through sharing of knowledge.

During my teaching tenure I have found that most of the students feel that mathematics is very difficult. Parents too think that it is tough and is unable to prepare their children for the practical use in their everyday life. They think that the bookish knowledge of mathematics is not sufficient for their children's educational qualification. But Kathmandu University has helped me to transform myself from conventional teacher to constructivist teacher laying the basis for contextualization of mathematics. Moreover, I have been imparting trainings to the teachers of my currently working school (United School) and supervising the school for the overall development of mathematics teachers and students for the past three years and which is all because of the contributions of Kathmandu University.

After joining Kathmandu University I learn how mathematics is learnt and taught. It encouraged me to study various books, research papers and articles and I did

so as far as possible as I could. And then I could taste the real flavor of mathematics. I learnt in Hammond (2000) that: "Mathematics grows as our capacity for thinking grows. Mathematics is constantly evolving and coexisting with culture. It is gradually stabilized all over the world as a universal subject because of cultural necessity (p. 51)." It is noticeable that there are many cultural influences on the way mathematics is studied. The Chinese abacus is one example how different cultures study mathematics. Some cultures like ours follow rote memorization as I did in my early childhood whereas other cultures are more concerned with more theoretical aspects of mathematics and some cultures emphasize its practical implications rather than theoretical ones. So, mathematics is a language of cultures because we see that every culture appears to have counting and sorting. Every culture has the same concept that $1 + 1 = 2$, no matter how they perform it by using fingers, sticks, stones, abacus, etc. That is why; I believe that mathematics can be contextualized in the context of our Nepali cultures. If Chinese can learn mathematics with their abacus, why can't we learn by our own? One lively example is that locals still enjoy buying and selling goods in *dharni* (equivalent to two kilograms and 400 grams) in Kathmandu valley. This is our culture! But we completely borrow mathematics from foreign soil and impose on our students to learn as a body of pure knowledge; and I call it that our mathematics (academic) is culturally decontextualised.

CHAPTER I

MY RESEARCH AND METHODOLOGY

My Perception of Research

Research....! What is 'research?' Is it re + search.....!...search again...! No, no....! In

the Oxford dictionary, research (n) means "careful study or investigation, especially

in order to discover new facts or information" (p. 1073). Ah! I perceived the

preliminary meaning of research from the dictionary. Then, is it the study that I

carried out to find the answer to the difficult questions given by my teachers in

schools? Or is it the investigation I carried out to find the thief when my money was

stolen in the classroom in Grade 8? Or I remember those

childhood days when I used to play with friends a game

called '*Gotti*'[5] with stones and can I find some new facts

from the patterns formed by the stones thrown on the

floor?... How should I relate the word 'research' to my

M. Ed. Study while writing thesis?

    At the initial phase, I found a book and reviewed it and found that "Research

comprises defining and re-defining problems, formulating hypothesis or suggested

solutions; collecting, organising and evaluating data; making deductions and reaching

conclusions; and at last carefully testing the conclusions to determine whether they fit

the formulating hypothesis." (Clifford Woody in Kothari, 2008, p. 1). In the other

book, "Research may be defined as the systematic and objective analysis and recording

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[5] A popular game among girls and boys of lower age also participate in this game. In this game there
are generally odd number of small pebbles (5, 7 or 9) in which one is selected as a key pebble which is
thrown up and remaining pebbles are collected one-by-one.

of controlled observations that may lead to the development of generalizations,

principles, theories, resulting in prediction and possibly ultimate control of events"

(Best & Kahn, 1999 in Belbase, 2006, p. 4). It means that research is an original

contribution to the existing collection of knowledge making for its advancement. It is

the pursuit of truth with the help of careful study, observation, comparison and

experiment. I argue that instead of experimentation my research inquiry is mainly based

on generating knowledge through my experiences of teaching and learning

(autoethnograhic perspective) guided by a specific form of the theory of reality

(ontology), the theory of knowledge (epistemology), and the theory of values

(axiology).

Therefore, I came to know that research includes both ontological assumptions

and epistemological considerations as knowledge is like an ocean where one can swim

deep or far across. Ontological assumptions concern the very nature or essence of the

social phenomena being investigated (Cohen, Manion & Morrision, 2002). These

assumptions deal with the social reality external to individuals. Therefore research

should embrace the truth of knowledge as whether it is created from outside world or

from one's own mind. 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, Manion & Morrision, 2002). As knowledge is vast to

comprehend, to me, research should help to communicate the nature of knowledge to its

intangible and soulful form so that knowledge becomes as it is (i.e., more subjective and

narrative—*lila-like*). Of course, I cannot forget the centrality of my values in taking this

research as and for my professional development.

In course my journey of learning and teaching, I realized that my research study

is closely related to my autobiography (about self) and ethnography (about other). In

turn, this insight contributed to autoethnographic writing throughout my research study. Autobiography research refers to a family of related forms of self study, including auto/ethnography (Ellis, 1997 as cited in Belbase, 2006). In my opinion autobiography is more like a life history research, described best by writing as an inquiry. On the other hand, ethnography means, literally, a picture of the "way of life" of some identifiable group of people. Those people could be any culture-bearing group, in any time and place (Wolcott, 1997). Wolcott (1997) further writes that the ethnographer's concern is always for context. One's focus moves constantly between figure and ground – like a zoom lens on a camera – to catch the fine detail of what individuals are doing and to keep a perspective on the context of that behavior. The study of autobiography inquiry and ethnography inquiry merged them into *auto-ethnography* (the use of hyphen is deliberate here!) inquiry and led me to use autoethnography inquiry throughout the research so that I could study about *self* and *other*.

In my perception, research is not only scientific rather it comprises the social, moral, political and cultural ground and various forms of realisms. So, 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 and Shapiro, 1998).

As I used the qualitative research method on the ground of autoethnography as an insider's methodology in which my personal and professional experiences became the key basis for this inquiry (Luitel, 2009, p. 35), I perceive that research has a broad field and scope which embraces knowledge from one's mind and his/her society. I came to know from Luitel (2009) that 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).

To articulate my research study I have taken the support of *small p philosophic inquiry* and *living educational theory* so that I can widely discuss my hidden practices in lived and living contradictions of my teaching-learning practices. In my opinion, it is quite easy to depict the already established educational practices in the form of package of knowledge but I claim that I present (probably explore about) myself a bit differently than others do after using small p philosophy and living educational theory via autoethnographic genre of inquiry and writing. Small p philosophy helped me in digging my teaching-learning practices deeply and living educational theory helped me in extracting and expanding my lived and living contradictions from my teaching-learning practices so that I can openly discuss them in this research inquiry to transform me into a practitioner influenced by Habermas' practical and emancipatory cognitive interests from that of technical interest.

I accept that we are always immersed in and shaped by historical, social, economic, political, and cultural structures and constraints, and those structures and constraints usually have domination and oppression, and therefore suffering, built into them; knowing involves caring for the world and the human life that one studies; the elimination or diminution of suffering is an important goal of or value accompanying inquiry and often involves critical judgment about how much suffering is required by existing arrangements; and inquiry often involves the critique of existing values, social and personal illusions and harmful practices and institutions (Bentz and Shapiro, 1998). Here to me, inquiry persuades the cognitive interests in the inquirer/researcher. Interest in general is the pleasure that we connect with the existence of an object or an action (Habermas, 1972, p. 198). Interests are fundamental orientations of the human species

and pure interest are fundamental, rational orientations. The fundamental interest is grounded in knowledge and human action. For Habermas, there is a relationship between the fundamental orientation of the human species towards preservation of life and knowledge (or rationality and reasonableness). Habermas further asserts that the way in which that orientation works itself out in the life structures of the species will determine what counts as knowledge. The manner in which rationality manifests itself will determine what a social group is prepared to distinguish as knowledge (Grundy, 1987, p. 8-9). Thus the fundamental interests will also constitute knowledge.

Selecting the Research Topic

My journey of research began without a specific topic; however there was no doubt on the central idea of my research- *impractical*, *rigid* and *foreign* (Luitel, 2009) mathematics. There were some questions in my mind and I had to find their solutions, and I got to find them in course of my research study. In course of my M. Ed. Study, I reviewed the M. Phil thesis of my facilitator Assistant Professor Shashidhar Belbase. He encouraged me to follow the qualitative research method on the ground of autoethnographic genre of writing. He suggested me to go through the articles and thesis of Dr. Bal Chandra Luitel. Once I got to review the article of Dr. Bal Chandra Luitel and Peter Charles Taylor called "Envisioning Transition Towards Transformative Mathematics Education: A Nepali Educator's Perspective." I paused myself at its sub-topic 'Contextualisation of Mathematics Education'. I also turned the pages of Luitel (2003). *Narrative explorations of Nepali mathematics curriculum landscapes: An epic journey.*

I got the central idea of my topic and on its very basis I started my research study and writing. Later I got to review Dr. Bal Chandra Luitel's Ph. D. thesis "*Culture, Worldview and Transformative Philosophy of Mathematics Education in Nepal:*

A Cultural-Philosophical Inquiry". Finally, I came to select the topic *'My Journey of Learning and Teaching: A Trans/formation from Culturally Decontextualised to Contextualised Mathematics Education.'*

My mind was partially occupied by decontextualisation of mathematics education in Nepal. I started practicing the contextualisation of mathematics education in my teaching practices and trainings. I encouraged the teachers to design some project works for the students about the contextualisation of mathematics. I also developed a diverse category of contextualisation of mathematics in Inter-school Math Olympiad (Quiz competition) in which each team has to present mathematics in the topic "Contextualisation of Mathematics". These practices were really supportive for me, teachers and students of my currently working United School to merely transform from traditional culturally decontextualised to contextualised mathematics learners.

During my research journey, Dr. Luitel suggested me to go through smec.moodle.com wherein I could find the article "Study Guide for External Students 2011" produced by Curtin University, Australia. I read it word by word and gained much idea about how research is being carried out. It also taught me the process of how to become an educational researcher.

Moreover, I was encouraged to search for other books and sites so that I could get more ideas and knowledge about qualitative research and autoethnography. I was influenced by Denzin and Lincoln (2005) stating 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. Denzin & Lincoln (2005) further adds

that Qualitative researchers deploy a wide

range of interconnected interpretive practices,

hoping always to get a better understanding of the subject matter at hand. It is understood,

however, that each practice makes the world visible in a different way. Hence there is

frequently a commitment to using more than one interpretive practice oin any study. Now

I got the central idea to climb a high mountain ahead of me- *literature review*.
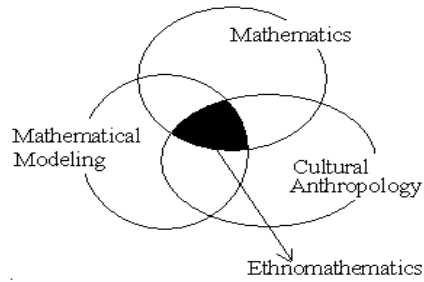
I then started to find the more supportive literatures and roamed hither and thither

for them in my busy schedule. It was a very difficult task I have ever experienced in my

educational practices to find literatures as I know that knowledge is vast. I read various

articles, books, dissertations and searched in Internets. I was then finally choked by Luitel

& Taylor (2009) that adopting a method of *writing as inquiry … mathematics as a*

body of pure knowledge, thereby constructing an integral perspective of a socially just

mathematics education in Nepal, a south Asian nation that is spiritually and

historically rich and culturally and linguistically diverse. And I was encouraged to

write some research questions. I wrote, rubbed … repeated the same for several hours

... I again read Luitel & Taylor (2009) and got stuck on "…… the notion of inclusion

refers to increasing the participation of all learners in mathematics, thus reducing the

possibility of their exclusion from classroom activities." I exactly found what I was

trying for several days and nights – inclusiveness which helped me connecting my

research study to cooperative learning. It was my destiny that fortunately I was

fascinated towards the diagram representing "A *holarchy* of three modes of

participation" which enhanced me to go through the Habermas' Three Fundamental

Human Interests – *Technical, Practical* and

Emancipatory (Grundy, 1987). In process of

reading various related materials, I found

that ethnomathematics deals with the

mathematics in people's culture. I turned the

pages of Orey & Rosa (2004) and
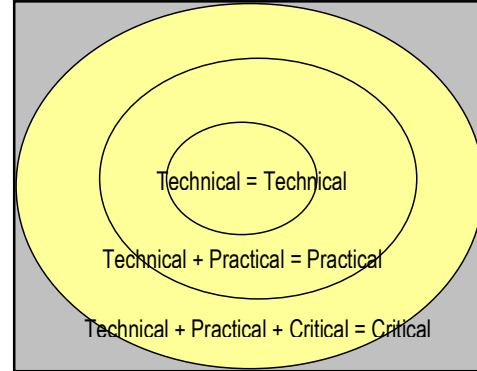
D'Ambrosio (1985) and learned some knowledge on how mathematics is linked with

cultures. After reading Belbase (2006), I was influenced by his writing genres and decided

to write my thesis with the journey of my mathematics learning and teaching experiences

from school to colleges/ universities in an autobiographical method.

Locating Myself

I locate myself as a researcher and a participant in the culture of inquiry throughout

the research. As a researcher, I interacted with Ass. Professors Shashidhar Belbase

and Tika Ram Pokhrel, Kathmandu University about my thesis in the initial phase and

then finally Dr. Bal Chandra Luitel guided me to shape up the thesis. As a participant,

I interacted with Dr. Bal Chandra Luitel about how culture and mathematics can be

related with the contextualisation of mathematics education in Nepal. Moreover, I

read some articles and books such as "*Research Methods in Education* (Cohen,

Manion & Morrison, 2002), Luitel (2003, 2007 & 2009), *Autoethnography: An*

Overview (Ellis, Adams & Bochner, 2011), *The Role of Contexts in Mathematics*

Classroom: Do they make Mathematics more real? (Boaler, 1993), to name a few.

I believe that a culture of inquiry is a modality of working within a field, an

applied epistemology, or working model of knowledge, used in explaining or

understanding reality (Bentz & Shapiro, 1998 as cited in Belbase, p. 11). To me, my

culture of inquiry is attached with the culture of autoethnography closely guided by technical, practical and emancipatory cognitive (and epistemic) interests. These interests constitute three types of science by which knowledge is generated and organised in our society. These three ways of knowing are empirical-analytic, historical-hermeneutic and critical (Grundy, 1987, p. 10). To perform technical interest-laden epistemic activities, I had to have a basic orientation towards controlling and managing the environment which is the form of the knowledge known as *positivism*. I have situated myself as a positivist teacher in the early part of my teaching career. To achieve my practical interest, I hope to have moulded myself towards understanding the environment so that I was able to interact with it in taking a right action within a particular environment. Finally I hope to have transformed myself into a constructivist teacher with practical and emancipatory interests; I am free to construct knowledge socially and critically. Emancipation for Habermas means 'independence from all that is outside the individual' and is a state of autonomy rather than a sallow form of libertinism. Habermas indentifies emancipation with autonomy and responsibility (Grundy, 1987, p. 16). It is only in the act of self-reflection that emancipation is possible. Because of interactive nature of human society, individual freedom can never be separated from the freedom of others. Hence emancipation is linked with social justice and ultimately with equality and equity.

Finally, neither fundamental orientation towards technical nor practical reasoning will ensure learning; the even more fundamental interest in autonomy and responsibility should be served. That's why; I believe that there must be an interest in freeing persons from the oppression of the technical interest and the deceit of the practical interest. And this is the interest in emancipation where I hope to have situated myself finally. Hence people <u>should</u> be free from any controlled environment

to constitute knowledge by interaction with the other people in the process of learning.

My articulate set of knowledge has been portrayed through autoethnographic genre of writing starting with an autobiographical journey of my learning and teaching experiences from school to college/university level because I believe that both learning and teaching are primarily relational (Montgomery, 2007, in Taylor & Wallace, 2007).

I believe that knowledge and action together constitute the life structures of human species and it indicates that neither knowledge nor action is sufficient to ensure preservation; both must interact for the welfare of the human species. The technical interest believes in construction of knowledge in *controlled* environment being influenced by positivism and the practical interest believes in construction of knowledge through *understanding* which enables rules to be formulated so that the environment may be manipulated and managed. In our Nepal, these two cognitive interests have been practiced all over the country directly/indirectly. In my experiences I found that there must be something new for knowledge construction – freedom, independence to learn, free to interact to each other – students versus students, students versus teacher so that there is no boundary for the participants to construct knowledge. That's why; I locate myself as an emancipatory teacher/learner in this research study because the emancipatory interest is meant to me 'independence from all that is outside the individual' and is a state of autonomy rather than libertinism (Grundy, 1987, p. 16). However, if I am talking about contextualization of culturally decontextualised mathematics of Nepal, I must be thinking about the inclusiveness of both technical and practical cognitive interests as it is very hard to reform the rigid system of the conventional teaching-learning practices in Nepal.

Rationale of the Study

In course of learning and teaching practices, I came to know that mathematics is very abstract and logical to the learners and teachers. However, mathematics can be contextualised so as to make it easier and fearless. Hence the main rationale of this study is to explore my practices of learning and teaching of mathematics education from school to university level so that I can develop my learning and teaching practices in the field of contextualization of mathematics education and hence transform myself from a culturally decontextualised to a contextualised learner and teacher.

In this 21st century the world has been growing up rapidly in the field of science and technology. Though Nepal is slow in this race, I have found in course of my teaching career of more than two decades in school that most of the students, parents, teachers, educators and researchers have felt some boredom and monotony in Nepali mathematics being learned and taught at schools. Nepali mathematics just accentuates algorithmic problem solving skills rather than practicality. Though the school mathematics curriculum has been changed and upgraded gradually and it has been attempted to incorporate some glimpses of cultural mathematics, the closed examination system sidetracks the students and teachers from learning and teaching cultural and contextual mathematics.

This thesis is significant to me, students, parents, teachers, educators and researchers in the following ways:

Firstly, the research will help me understand my teaching and learning methods. Moreover, it will help me to transform from technical to practical and critical teacher/thinker.

Secondly, this is an ample opportunity for me writing the thesis in a narrative inquiry which will help me understand the qualitative research method in my first attempt of writing the thesis.

Thirdly, this research will be helpful for me in linking academic mathematics to cultural mathematics (ethnomathematics) in Nepali societies and communities.

Lastly, this is a new approach to writing thesis for me which helps me and most probably the Nepalese researchers to explore cultural mathematics through narrative and comprehensive genres of writing.

Research Questions

As I have chosen the autoethnographic genre of writing situating myself in the cultural context, I have prepared the following research questions in the process of inquiry.

My research questions:

1.   Considering my experience as a student and teacher, how can I explain the culturally decontextualised features of Nepali mathematics education?

2.   How can Nepali mathematics be contextualised through inclusiveness, cooperative learning and ethnomathematics?

3.   How can a culturally contextualized mathematics education enable meaningful learning of mathematics?

4.   How could I transform myself from technical to practical and emancipatory teaching and learning of mathematics so as to make it more meaningful to students' lifeworlds?

So far as the answers of the research questions, I have presented all of them directly/indirectly in the chapters going from the beginning to end of the thesis.

Theoretical Perspective

Upon the wide study and interactions with facilitators of Kathmandu University and friends, I was encouraged to situate myself in the socio-cultural context through multiple genres of texts and textuality. In this study I have attempted to exercise the autoethnographic genre of writing supported by *small p philosophical inquiry* (Luitel,2009) and *living educational theory* (Whitehead, 2008) in the socio-cultural contexts with the help of Habermas' three fundamental cognitive interests – *technical*, *practical* and *emancipatory* to describe how I have tried to contextualise the culturally decontextualised mathematics in my teaching-learning practices.

Technical Cognitive Interest

In the process of constructing the multiple genres of writing, I came across the type of knowledge generated by experience and observation which I was using directly/indirectly in my research study. I found that this type of knowledge is grounded in the need of human species to survive and reproduce both itself and those which are necessary and worthwhile for the society. And to achieve this purpose, persons have a basic orientation towards controlling and managing the environment. Habermas calls it the technical interest.

Grundy (1987, p. 11) states that this technical interest is congruent with the agenda of the empirical-analytic sciences which generates the knowledge grounded on experience and observation, often produced through experimentation. In my understanding this is the form of knowledge guided by 'positivism' which advocates knowledge as production and organization. Compte who coined 'positivism' uses "positive" to refer to the actual in contrast to the 'merely' imaginary (Nevertheless, I do not believe that imagination and imaginary should be qualified by the term merely. Can I live and teach without imagination?). Hence for the empirical-analytic sciences,

knowledge consists of certain theories about the world which are grounded in our 'positive' observation and experience of that world. The series of observations and experimentation will certainly coin some conclusions in the form of knowledge which also has also predictive power of what will happen tomorrow. Henceforth, this prediction will allow us, potentially, to control our environment.

According to Habermas, the technical interest gives rise to a certain form of action (instrumental) which is governed by technical rules based upon empirical knowledge (Grundy, 1987, p. 12). It means that one can formulate a series of rules for action which will guide and promote our pupils' learning. This is a kind of positive reinforcement to lead the pupils' learning. This technical cognitive interest (positivism) gives rise to the objective curriculum as a product. This curriculum obviously implies that the *educator* (teacher) will produce an *educand* (pupil) who will behave according to a person who has learnt what we set out to teach. To accomplish this mission of teaching-learning agendas the educator must control both learning environment and the learner. Hence the technical interest objectifies reality and considers the environment as an object (what positivism advocates). This objectified environment comprises the pupils as objects and their behaviour and learning are managed by the teacher. It means that more clearly the objectives of the curriculum which guide the teaching act, more predictable will be the outcome. Thus the more specific the objectives and the more clearly the curriculum document is set out, the better are the chances that the product will resemble that which was envisaged in the statement of objectives. Gagne (1967) have argued that "the specification of objectives is all that is needed in the process of curriculum construction. Once objectives are defined, everything else, even the selection of content, is determined." In my opinion, it is a kind of imposition of knowledge to learners and there is an

important consequence for the classroom practitioner. Once the curriculum is designed elsewhere, the teacher will be under pressure to be productive in the ways envisioned by the designers, and the quality of the teachers will be judged by the products of his/her actions. Henceforth the pre-occupied teacher will give pressures to their learners in the ways he/she is guided by the curriculum and the learners will follow the principles, rules and laws depicted by the teachers in the controlled environment (classroom).

Reviewing the above literatures I remember those days of my learning mathematics in school and of my teaching in secondary school. "Why didn't you complete your homework?; you pathetic little….I know how to treat you. Oh…I forgot my stick! ... (Luitel & Taylor, 2007, p. 6). One can envisage in Luitel & Taylor (2007) how Mr. Giant has controlled the environment in the classroom! To fulfill the objectives of the curriculum the teacher has to be very much strict in the classroom so that all the pupils will do their assigned works on time. However, despite the fact that the curriculum is objective, a teacher can make the curriculum interesting in the classroom environment by linking mathematics to the cultural context. So, I will portray how I was guided by the technical interest to learn the culturally decontextualised mathematics in my schools and also lay the methods of my teaching as a beginner influenced by positivism in the next chapters directly/indirectly.

As the technical cognitive interest is grounded on the form of knowledge called positivism, Luitel (2009) asserts that this paradigm (positivism) can be characterised by its emphasis on pre-determined research design, objective knowing,…….., quality standards of validity and reliability, and a one-size-fits-all (formal, hypothetico-deductive logic) thinking model. Further he adds, "…. Adherents of this paradigm promote a decontextualised, impersonal and exclusively propositional

genre, thereby dismissing contextualised, arts-based, personalised genres of research representation." However, I cannot leave it without relating my research inquiry with it. Its widespread usefulness cannot be undermined because I was grown up within this paradigm and its hegemony is still great all over the world.

Practical Cognitive Interest

As I depicted above that the basic orientation of the technical interest is towards control of environment resulting to the learners as products but the basic orientation of the practical interest is towards understanding (Habermas, 1972, p. 310). It is not the sort of understanding which enables rules to be formulated so that the environment may be manipulated and managed. Rather, it is an interest in understanding the environment so that one is able to interact with it (Grundy, 1987). In my understanding, the practical interest grounded on the interaction between teachers and learners and amongst learners. It shouts for the answer of the question 'What ought I to do?, but not 'What can I do?' To get the answer of this question, understanding of the meaning of the situation is required. It is an interest in taking right action within a particular environment.

Knowledge produced through the making of meaning is associated with the historical-hermeneutic sciences. The production of knowledge through the making of meaning is the task associated with the historical-hermeneutic sciences. I was earnest about historical and literary interpretation and interpretative agendas of disciplines such as sociology and some psychology within the scope of these sciences. Therefore, I should not remain flaccid to comprise the paradigm called *interpretivism* in my journey of research study. Epistemologically, interpretivism gave rise to two key epistemic metaphors so as to guide my research journey: knowing as interpreting and constructing (Luitel et al., 2009). I also came to understand that interpretivism is a

radical response to the unidimensionality embedded in the interpretation of phenomena, events or situations under the positivist paradigm (Willis, 2007 as cited in Luitel, 2009).

My aim was not to use the positivist paradigm in my research study but to interpret my experiences and practices so that I could freely express my understanding in textual forms through 'historic-hermeneutic and humane' sciences which helped me to learn how access to the facts is provided by the understanding of meaning, not observation. Hence, Habermas' practical interest helped me interpret the situation in a socio-cultural environment for understanding of meaning. It advocates not the action upon an environment which has been objectified; but the action with the environment. Hence the knowledge which guides such action is subjective, not objective. By interaction, I understood communicative action between at least two acting agents. I then reviewed the practical interest in my thesis writing in understanding the environment through interaction based upon a consensual interpretation of meaning.

I understood that if we accept that the curriculum is a practical matter, this entails that all participants in the curriculum event are regarded as subjects not objects as that in technical interests. Then I merely regarded the Habermas practical interest as that of knowledge construction through social interaction between teachers and learners. I took advantage of this interest in *cooperative learning* and realized that in cooperative learning students work with their peers to accomplish a shared or common goal. The goal is reached through interdependence among all group members rather than working alone. Each member is responsible for the outcome of the shared goal. "Cooperative learning does not take place in a vacuum." On the other hand, not all groups are cooperative groups. Putting groups

together in a room does not mean cooperative learning is taking place (Johnson &

Johnson, p. 26). I agree with Dahley (1994) that in order to have effective cooperative

learning the following 5 essential elements are needed.

Positive interdependence: Each group member depends on each other to accomplish a

shared goal or task. Without the help of one member the group is not able to reach the

desired goal.

Face-to-face interaction: It promotes success of group members by praising,

encouraging, supporting, or assisting each other.

Individual accountability: Each group member is held accountable for his or her

work. Individual accountability helps to avoid members from "hitch-hiking" on other

group members' accomplishments.

Social skills: Cooperative learning groups set the stage for students to learn social

skills. These skills help to build stronger cooperation among group members.

Leadership, decision-making, trust-building, and communication are different skills

that are developed in cooperative learning.

Group processing: Group processing is an assessment of how groups are functioning

to achieve their goals or tasks. By reviewing group behavior the students and the

teacher get a chance to discuss special needs or problems within the group. Groups

get a chance to express their feelings about beneficial and unhelpful aspects of the

group learning process in order to correct unwanted behavior and celebrate successful

outcomes in the group work.

As the technical interest speaks about the hermeneutical interpretation, it

helped me making meaning through an act of *interpretation* and thus providing a basis

for making decisions about action. On its very basis, the curriculum is concerned with

the interaction between teacher and learners as in cooperative learning. Further,

learning, not teaching, will be the central concern of the teacher (Grundy, 1987, p. 69).

Certainly it would be a reform of Nepali curriculum if it is guided by practical interest

so that culturally decontextualised mathematics can be contextualised. I agree with

Luitel (2009) saying that "….I felt that I needed somewhat holistic thinking (not

'grandiose' though) in my research design so that I could construct visions about

solving the problem of culturally decontextualised mathematics education in Nepali

students." Thus I needed to review the critical pedagogy which is supported by the

Habermas' third cognitive interest-*emancipatory*.

Emancipatory Cognitive Interest

As I read Grundy (1987, p. 17), I understood that neither fundamental orientations

towards technical nor practical reasoning will ensure the interest in autonomy and

responsibility. That's why; there must be inclusion of an interest called *emancipatory*

interest in freeing persons from the coercion of the technical and the possible deceit of

the practical. As I have already presented before (in *Locating Myself*) that

emancipation for Habermas means 'independence from all that is outside the

individual' and is a state of autonomy and libertinism. Habermas indentifies

emancipation with autonomy and responsibility. I also envisaged how the

emancipatory interest translates into action in the real world. Actually it gives rise to

autonomous and responsible action based upon prudent decisions informed by certain

knowledge. The emancipatory interest generates critical theories which are theories

about persons and about society which explains how coercion and distortion operate

to inhibit freedom. Freudian's psychology about the inhibition of freedom in

individuals and Marxism about the inhibition of freedom in whole societies are

examples of critical theories. Here I emphasize on critical theories as a person always

exhibits his/her right to freedom. Hence, I believe that teachers and learners also want

to feel free to express their views in a social interaction to construct some sort of knowledge.

I understood that emancipatory cognitive interest is a fundamental interest in emancipation and empowerment to engage in autonomous action arising out of authentic, critical insights into the social construction of human society. I then did not setback to connect it to *praxis*. Praxis is a fundamental concept to Freire's work who claims that…. men's activity is theory and practice; men's activity consists of action and reflection: it is praxis…(1972b, p. 96 as cited in Grundy, 1987, p. 104). Praxis is also fundamental to emancipation as throughout Freire's writing he refers to 'liberating' education, and hence Freire's interest in liberation and Habermas' emancipatory interest resemble one another. Some of the constitutive elements of praxis as they are emerged from Freire's work really helped me in shaping my understanding of curriculum as praxis which are listed below:

(i)   The constitutive elements of praxis are action and reflection.

(i))   Praxis takes place in the actual, not the hypothetical world.

(iii)   Praxis operates in the world of interaction, the social and cultural world.

(iv)   The world of praxis is the constructed, not the natural world.

(v)   Praxis assumes a process of meaning- making which recognizes meaning as a social construction.

I have experienced that the educational practices in Nepal are limited to the Habermas' technical and practical cognitive interests. But I have attempted to portray my emancipatory interest in my recent teaching and learning practices through this research study. However, the most important principle that I drew from these three interests is that curriculum is a social construction. On its very basis, I have tried to portray my journey of learning and teaching and tried to transform myself from

culturally decontextualised to contextualised mathematics learner and teacher through autoethnography as a genre of writing.

Small p philosophic Inquiry and Living Educational Theory: Two broad visions of knowing

In course of my research study I came to realize that people's theoretical view of mathematics can be different than what it looks like. I used to think that mathematics is a body of pure knowledge as if it is borrowed from *foreign* (Luitel, 2009). On the other hand, some people have different views: the absolutist view of mathematics sees mathematics as universal, objective and certain, with mathematical truths being discovered through the intuition of the mathematician and then being established by proof while the opposing view of fallibilists is that mathematics is an incomplete and everlasting 'work-in-progress' (Ernest, 1996, p.1) implying to me that it is corrigible, revisable, changing, with new mathematical truths being invented, or emerging as the by-products of inventions, rather than discovered.

I was then much more leaned towards the fallibilist view and influenced by *small p philosophical inquiry* when I read Luitel (2009, p. 37) and found that "….small p philosophical inquiry complements auto-ethnography via the epistemic metaphor of *knowing as envisioning*…. As a personal practical knower my focus was on making better sense of my practice, whereas a personal-experiential seeker I tried to be more than just a sense maker: I strived to develop visions of possibilities". I envisaged in me that there must be the possibility of linking mathematics to cultural contexts thinking that mathematics is fallible, not as rigid as it is a body of pure knowledge. Then I chose small p philosophical inquiry to distinguish it from (capital P) Philosophical Inquiry which seems to privilege absolute Idea (and Theoretical View of Rationality) over personal-experiential ideas arising from my personal and

professional lifeworlds (Luitel, 2009, p. 37). It is meant to me that "small p" philosophical inquiry gives emphasis on the personal meaning making and meaning seeking process.

There is much more mathematics in me and around me which are accountable to be spoken out. Mathematics is not rigid; I envisaged it through my practices and experiences that only academic (culturally decontextualised) mathematics is not the ultimate knowledge-giving source for the students. I have seen the possibility of bringing in mathematics from different (cultural) contexts in the classroom to make meaningful mathematics teaching and learning. I agree with Op'Teynde, Corte, & Verschaffel (2003) that "recent theories on cognition and learning point to the socio-historical embeddedness and the constructive nature of thinking and problem solving. According to these theories, each form of knowing and thinking is constituted by the meanings and rules that function in the specific communities in which they are situated (e. g. the scientific community, the class, the group). Acquiring knowledge or learning, therefore, consists of getting acquainted with the concepts and rules that characterize the activities in different contexts. As such, learning becomes fundamentally a social activity (p. 13)".

Further, I agree with Luitel (2009) that "As a methodology, I envisaged that small p philosophical inquiry was guided mainly by the culminating epistemic metaphor of knowing as envisioning, a constellation of multiple ways of knowing, such as deconstructing, constructing, re-conceptualising and imagining (p. 38)." It gave me confidence that I could mould the various mathematical issues into my research study in support of small p philosophical inquiry to promote multiple and perspectival thinking through metaphorical, poetic and dialectical logics. Through

small p philosophy I can interact to myself about my teaching-learning experiences rather than big theories propounded by philosophers.

I have already mentioned above that capital P Philosophy privileges absolute idea and Theoritical View of Rationality over personal-experiential ideas, arising from personal and professional lifeworlds aiming to generate universal theories (Luitel, 2009). To me, the meaning of 'Philosophy' is 'love of wisdom' (Sindhu, 2005, p. 79). From this viewpoint, I claim that finding out knowledge and truth and to perceive its actual form is called 'Philosophy'. However, (capital P) philosophy is limited on big theories discovered by various philosophers such as Thales (who advocates that the world was created from water), Pythagoras (who related mathematical knowledge to God), Socrates (who established the importance of man in the society), Aristotle (who worked on natural science physics giving a vast amount of information on astronomy, meteorology, plants and animals), Descartes (who propounded the principle of dualism), Dewey (who encouraged philosophy toward analysis of practical aspects) (Sindhu, 2005, pp. 85-93) and many more. From these, I envisage that philosophy is a source of wisdoms. Moreover, philosophy emphasize on practical knowing as a key basis for wisdom (Luitel, 2009, p. 37). Here I merely claim that capital P philosophy is limited to a dualistic imposition of big theories over practitioners' local wisdoms and ideas. Merely opposing to this viewpoint of (capital P) Philosophy, I found small p philosophy helping me inquire on my lived and living contradictions and experiences. Contrary to dualistic idea, small p philosophy encouraged me to entail inclusive non-dualistic ideas and practices emphasizing practical knowing throughout this research study. I envisaged small p philosophy as a non-dualistic ideas and practices giving

rise to dialectical relationships found in local practitioners and helping me to dig out my contextual mathematics from cultural lifeworlds.

There are many lived and living contradictions in teaching-learning practices that I have experienced in my educational journey and I was looking for supportive theories. After all, in supervision of Dr. Luitel I was introduced with a new theory called "Living Educational Theory" by Dr. Jack Whitehead, Professor at Liverpool Hope University in the UK. I read his articles and convinced to use "*Living Educational Theory*" in my research study. According to Whitehead (2008), "A living theory is an explanation produced by an individual for their educational influence in their own learning, in the learning of others and in the learning of the social formation in which they live and work (p. 104)." This is the theory which helped me in inquiring my living and lived contradictions that I experienced and encounter. A simple example is that our Nepali curriculum is based on various educational theories and philosophies borrowed from *foreign* (Luitel, 2007) to implement in the context of Nepali soil but my lived experiences encourage that it is not the curriculum that help students in knowledge construction rather it produces predetermined package of knowledge. I have experienced various mathematical practices done (and being done) in the cultures of my society. Instead of inclusion of such mathematics, our curriculum includes the foreign based package of knowledge.

I am now looking to develop educational thought and practices which promote education as a humanizing influence on each person and on society locally, nationally and internationally through this research study report so that it contributes to the development of knowledge and understanding in all fields of education, characterising all works with values arising from hope and love

(Whitehead, 2011). Whitehead further asserts that "The educational thought practices are the explanations that individuals produce to explain their educational influences as they explore the implications of asking, researching and answering practical questions of the kind, 'How do I improve what I am doing?' I call such explanations, living educational theories. Living educational theories differ from traditional propositional or dialectical theories in that the explanations of activities are not deducted from the general conceptual framework of a traditional theory, they are created in the course of enquiries of the kind, 'How do I improve what I am doing?' (Whitehead, 2011)"

In my research study I have focused two strong parts of 'living educational theory which I shall elaborate in brief in the context of my research inquiry.

(a) Loving dynamic energy: Our educational theories have been structured through either a propositional or a dialogical logic. Proportional logic eliminates contradictions between mutually exclusive statements such as I am free/I am not free. Dialectical logic includes contradictions in the sense that you and I can exist as living contradictions in holding together the experience of being free and not free at the same time. Creating living theories involves an inclusion logic which is rationally dynamic and can draw insights from both propositional theories and dialectical theories (Whitehead, 2011). I have then used loving as an explanatory principle and living standard of judgment for evaluating the validity of claims to educational knowledge throughout my research inquiry. I agree with Whitehead (2011) "With love, education becomes an open space for thought from which emerges knowledge. When a teacher and a student love one another, they do not have sex, they do not merely care for one another, nor do they pass knowledge

between each other. If education is to be a space of thought, we must insist with Freire that 'It is impossible to teach without the courage to love.'"

(b) *Living contradictions:* I have encountered the need to respond to personal and social contexts that contribute to one's existence as living contradiction in the sense of holding together the values that carry hope for the future of humanity together with their negation (Whitehead, 2011). Keeping a view on the importance of acknowledging historical and socio-cultural influences that can constrain or open up opportunities for the expression of love and hope, I have dug my teaching-learning experiences to depict that lived and living contradictions have great influences on our educational practices. The earthquake destroys the human constructions and takes many lives; people are happily celebrating Christian's Christmas party and Hindu's *Dashain* festival; terrorists are killing many people; students are going to the school for their educational purposes and teachers are teaching their students to produce the future of nation are some contradictions in which we encounter in our socio-cultural lifeworlds. In a classroom situation, a teacher is scolding a student and students are in fear of getting knowledge, even then teaching-learning process is lively in the classroom. And it is important to face such living contradictions between our values and their negation in our educational inquiries. In the milieu of such contradiction I situate myself throughout my research study hoping to protect and extend the values that carry hope for the future of humanity (Whitehead, 2011).

That's why; I have chosen *living educational theory* to conceptualise my educational research from the relatively narrow perspectives of traditional social science in spite of a major body of literature, comprising practitioner's stories of practice, that shows educational research as a process of making sense of our own

personal and professional lives through personal inquiry as we try to realize our values in our practice.

Autoethnography: A Method of Inquiry

I believe that *autoethnograhy* is a method of expressing one's personal experience standing in the midst of cultures. Thus autoethnography is an approach to research and writing that seeks to describe and systematically analyze (*graphy*) personal experience (*auto*) in order to understand cultural experience (*ethno*). This approach challenges canonical ways of doing research and representing others and treats research as a political, social-just and socially-conscious act (Ellis, Adams, & Bochner, 2011).

Luitel & Taylor (2007) state that autoethnography is a hybrid that combines ethnographic inquiry and autobiographical inquiry. Etymologically, the term autoethnography comprises three different words: *auto, ethno* and *graphy*, which signifies the textual representation of one's own personal experiences in his/her cultural context (Luitel, 2003). In my understanding, I would say that autoethnography is the sum of autobiography describing self milieu and ethnography describing cultural milieu. Hence, I believe that autoethnography is "….research, writing and method that connect the autobiographical and personal to the cultural and social context. This form usually features concrete action, emotion, embodiment, self-consciousness, and introspection….and claims the conventions of literary writing" (Ellis, 2004, p. xix, as stated by Jones, 2005). Moreover, Autoethnographic writing can be depicted as the metaphor of a camera (Luitel, 2003), which focuses on the rarely heard stories (van Manen, 1988). To me, autoethnography is a qualitative research methodology that emphasize a more personal, almost intimate level of study, it renders the researcher-participant opportunities to explore past and present

experiences while gaining self-awareness of his/her interactions and their socio-cultural effects (Butler, 2009). In my research study, I used autoethnography as a method towards generating creative and layered understandings of issues (i.e., culturally contextualised mathematics education) under my inquiry (Luitel, 2009).

Ethnomathematics: My Cultural Mathematics

I can see my children playing with stones and logs of wood and making different patterns which reminds me of my childhood world. I also have experiences of playing with stones and making different models (e. g. house, cart, idols, etc).

I used to play with my younger brother who usually assisted me in making model carts and whatever we see in and around home. I made different clay models. It was all mathematics in there. I was learning mathematics at home. Factually, various objects persuade children to play with them and they try to make similar models.

During the day of *Bhai Tika,* every year my sisters worship me and put seven colored *tika* (rice grains) on my forehead and give me blessings. Before that, there is a ritual of preparing *tika-place* with flour in which circular patterns can I see. In my *Newari* culture one can see the festival of *cart-pulling* loaded with God.

I believe that all people use mathematics in their everyday life. As a researcher I found that ethnomathematics offers me to examine how I can learn/teach mathematics in the context of school, culture and society. I

have seen farmers break up the soil using hand tools and plough the field for planting

seeds and harvest the plants; carpenters use

their tools to make furniture. I believe

that mathematics as it is now is transformation

of culturally and socially practiced

mathematics which was carved into academic mathematics. The inclusion of

mathematical ideas from diverse cultures can make the mathematical understanding

and recognizes different practices of a mathematical nature in varied cultural

procedural contexts. If student experiences from their cultures

can be linked to academic mathematics, it will construct a

complete curriculum of mathematics.

Ubiratan D'Ambrosio, the well-known Brazilian

mathematics educator developed the idea of ethnomathematics

into concept and a program which has emphasized the mathematics practiced by

cultural groups, such as urban and rural communities, groups of

workers, professional classes, children in a given age group,

indigenous societies, and so many other groups that are

indentified by the objectives and traditions common to these

groups (D'Ambrosio, 1985, p. 1). He defines ethnomathematics (Orey & Rosa,

2004)as, "The prefix *ethno* is today accepted as a very broad term that refers to the

social-cultural context, and therefore includes language, jargon, and codes of

behavior, myths, and symbols. The derivation of *mathema* is difficult, but tends to

mean to explain, to know, to understand, and to do activities such as ciphering,

measuring, classifying, ordering, inferring, and modeling. The suffix *tics* is derived

from *techne*, and has the same root as art and technique" (D'Ambrosio, 1990, p. 81).

In this perspective, I incorporated ethnomathematics in my research study so that culturally decontextualised mathematics can be livelihood to teach and learn in academic mathematics. In this study I tried to present ethnomathematics as mathematics practiced or being practiced in our cultures, homes and surroundings by different groups of people such as farmers, carpenters, etc. Over all, I believe that students need to be encouraged to develop their skills in critical thinking and analysis that can be applied to all areas of life. These skills include vital issues involving health, environment, race, gender, and socioeconomic class (D'Ambrosio, 1990, 1998; Freire, 1970; Zaslavsky, 1998 as cited in Orey & Rosa, 2004). This suggest me that ethnomathematics can be defined as " the study of the culturally-related aspects of mathematics; it deals with the comparative study of mathematics of different human cultures, especially in regard to how mathematics has shaped, and in turn been shaped by, the values and beliefs of groups of people (Hammond, 2000, p. 11)."

Numerous local practices can be found in Nepali communities to link mathematics curriculum such as practices in farming, local business, household activities, children's games, cultural practices, arte-facts and social events. There are many traditional games played by children which are highly significant activity for enhancing their learning of school mathematics, especially by adding a focus on learning by doing. The potato growing can be linked with arithmetical operations such as addition, subtraction, multiplication, division, time and work, ratio and proportion and also applied geometry of designing the plot, shaping the groove and mapping the queue of potatoes. Similarly, terracing farming is a popular method of managing land in the hilly region in Nepal (UNESCO, 2008).

If we observe the bamboo basket (called *doko* Nepali), we can find different geometries in it. A nice geometrical pattern can be seen in it. We can find straight

lines,parallel lines, intersecting lines, curves, horizontal lines, vertical lines, sloppy lines, triangles, quadrilaterals, squares, rectangles, parallelograms and polygons (pentagons, hexagons, etc.). *Doko* is itself a frustum. If we use this *doko* as a teaching material in the classroom for teaching geometrical shapes, then the academic mathematics can be contextualised culturally for meaningful mathematics learning.

doko

In fact, various resources are available in local communities for teaching and learning of mathematics contextually. These resources can be used as teaching materials in classroom practices and use of such culturally related materials encourage students to value their own culture and in return, students gradually love and enjoy learning mathematics.

Lila-play, Drama, Dialogue and Narrative

During my research study, I applied *lila-play*, drama and dialogue in the form of narrative genres and logics to enrich my inquiry into the problem of culturally decontextualised mathematics education faced by Nepali students and teachers. These components represent the different ways of knowing, thinking and representing. I discuss how I employed these different research logics and genres in my research inquiry.

a) Lila-play: I used Lila-play so as to generate my culturally embedded experiences and practices. In my research study, Lila helped me in exploring felt and mythical realities. The idea of *lila* could be associated with the chaotic and unintelligible nature of our lifeworld which could be explained, represented in a better way via storytelling, dramatic play and metaphorical representation. In Sanskrit, *lila* means disorder, an antonym of *rita* which means order.

In my drama I stand as a story teller as well as a narrator represented by hyphenated word storyteller-researcher telling the story in all dramas. I have tried to present the chaotic and unintelligible nature of students' lifeworlds which are disorder (*lila*) because of predetermined knowledge package of Nepali curriculum (Chapter 2) while I have tried to present the contextual mathematics education to depict the ordered (*rita*) and lively knowledge that can be injected into students' mindset in learning practices (Chapter 3). Moreover I have used *lila* as antonym of *rita* to represent *lila and rita* as the opposite side of the same coin representing the very paradox of what we experience the limitation of any category being imposed upon reality.

As I mentioned above that I was grown up with the Hindu culture and values and have experienced so many mythological practices in various festivals. These mythological practices have influenced my living standards and I have leaned towards them. In my childhood I have listened to my father telling me mythological tales and stories based on numerous Gods such as *Ram, Krishna, Durga, Shiva,* etc. As Nepal is a south Asian country of diverse cultures where it is believed that millions of gods and goddesses are worshiped across the country, my childhood passed witnessing various plays and drama (especially *lila-play*) such as *Ram-lila, Krishna-lila, etc.* in my village but as I grew up gradually to adult, western cultures had their direct/indirect dominance over my culture and those *lila-plays* are slowly overshadowed. Now-a-days, I can rarely find those *lila-plays* being played in my village. These experiences of *lila-plays* have great implications on my living standards and I could not remain untouched by them in course of my teaching-learning practices for they provide me sufficient morals and cultural values to be proud of. I thought that if I could perform my teaching-learning

practices standing in the midst of my cultural milieu, I would be able to do some justice on me and enjoy both teaching and learning meaningfully with satisfaction. That's why; I have attempted to explore my teaching and learning practices linking my research study to *lila-play*.

I still remember my father telling me the mythological story of *Ram-lila* in which the God *Ram* takes part in a marriage ceremony of *Sita* (daughter of King *Janak*). According to Hindu mythology, once the King *Janak* arranged a marriage ceremony of *Sita* where a very heavy arrow was to be lifted to get married with *Sita*. Many tried to lift it but no one could do that. Finally, Lord *Ram* took the challenge and he could easily lift it. When he pulled the string of the arrow, it was broken into several pieces. The king *Janak* was inspired and gave his daughter *Sita's* hand to *Ram* and they finally got married. So far as I have understood the moral of this *Ram-lila* is that, *a confident person assembles his/her courage to attempt an impossible work and in return tastes the flavor of success*. I have linked it to my research so as to explore how to build up my confidence level in teaching and learning of mathematics. Moreover, I have also linked it with the confidence building process of my students in my teaching practices. I also dare to link it to students (mine too) lived and living contradictions which may cause to lose their confidences but teachers can mould them into proper forms so that students are confident in knowledge construction and they are not lost in the learning process.

Lila can be interpreted as a divine play which is beyond the regulations of law of *karma* (Hindudharma Forum, 2012). According to *Bhagawat Gita* (It is the essence of Vedic knowledge)*,* Lord *Krishna* was not an ordinary man but the Supreme Godhead Himself, who had descended to earth and was playing the role of a prince….full of charismatic and divine powers to support the truth (Prabhupada,

1972, 1983). In his childhood *Krishna* was renowned for stealing ghee/butter (called *makhan* in Nepali) from his own house and neighbours' houses for ghee/butter was his favourite and delicious foodstuff. Village women and girls used to feel lucky if *Krishna* could not reach their house any day. But *Krishna* was so clever that he used to take away cloths of women who were swimming in a pond so that they could not come out of the pond and he could finish his trial of stealing *makhan* from those women's houses. *Krishna* was always passionate of having *makhan* as it was his delicious foodstuff and he used various logical tricks and skills to get it.

I have attempted to link this *Krishna-lila* to my teaching and learning practices with the moral that *one should have passion of learning which gives rise to various logics of learning mathematics.* And I have tried to apply it to the classroom teaching-leaning practices so as to encourage students to have passion of learning mathematics. Moreover, I have attempted to apply *lila-play* throughout my research study and inquiry so as to value my cultures I have grown all along.

b) Drama as a Metaphor: Born and grown in the milieu of cultural and religious family experiencing my lived and living contradictions (Whitehead, 2011), I am closely influenced by *lila-play* (as I mentioned above); and I was very much conscious about how to generate and present accumulated knowledge that I have gained throughout my learning and teaching practices. Then in course of research study I chose drama as a metaphor in knowledge generation so as to set the scene for my chapters and henceforth my lived and living contradictions and experiences along with my visions can be presented interestingly.

Moreover, in course of research journey, I was drawn by Luitel and Taylor (2007) saying that " the culminating 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 system arising from people's practices (Luitel, 2009, p. 78). Then I had to present the transformation of "the image of *mathematics as meaningless subject"* into the image of ethnomathematics as mathematics of the people (Luitel, 2009, p. 5) by contextualising culturally decontextualised academic mathematics (body of pure knowledge). For this, I used drama as a metaphor to construct, deconstruct, conceptualise and vividly present all my accumulated knowledge in my research inquiry.

c) Dialog: I have encountered with so many lived and living contradictions (Whitehead, 2011) in my teaching and learning practices and there had been my wide range of arguments through discussions and interactions with colleague teachers to reach logical end. I have also seen villagers gathering at a place to resolve the community problems through dialogs. I have experienced that strong logics through dialogs give rise to generating and constructing knowledge.

Taylor, Settelmaier & Luitel (2009) assert that dialogical logic is often found in the company of metaphorical logic, which promotes open and embodied inquiry for exploring multiple facets of knowledge and knowing (p. 8).So, I used dialog so as to depict the dialectical nature of knowledge so that I can present art of discovering and testing truths by discussion and logical argument. I also used dialog as a criticism that deals with metaphysical contradictions and how to solve them. Moreover I tried to disseminate my hidden knowledge accumulated in my mind-set through dialogs in drama.

d) Narrative: My childhood is influenced by various mythical stories told by my parents. Such stories have a great power of enhancing imaginative power in me.

I used to imagine how I could become a great person like gods *Krishna* and *Ram* in my childhood. I can still remember a story of Moon eclipse narrated by my mother. According to my mother, the moon eclipse occurs when the God of shoemaker (Shoemakers are people from lower caste in Nepal and they are called *sarkis* or *chamaars* in Nepali community) swallows it the whole moon slowly. In the process of eclipse there was a rivalry competition of shouting *chhod chamaar chhod* (get away *chamaar* get away) by the people of higher castes and *bal gar bhagavan bal gar* (try harder, God, to swallow) by shoemakers. It was said that the world would destroy if the moon was swallowed wholly and I used to get terrified. In the early childhood it was like a fairy tale for me. I used to imagine how this world was created by God. In latter part of my childhood I read in books that the moon eclipse is due to revolution of the earth and the moon. There used to be arguments in my mind-set between my pre-imagination thinking and post-imagination thinking about the creation of this world. In my opinion, such imaginative power enhances logical thinking. So such stories have great implications on my living standards and it has encouraged and supported me to choose narrative genre and logic in this research inquiry as they enhanced my imaginative power and hence I was able to give this shape to my research study. I have read or heard somewhere the famous scientist Einstein saying that, imagination is more important than knowledge. From this, I understood that imagination helps us in generating and constructing knowledge. Then I claim that I dared to attempt my narrative genre in this research writing as such stories helped me to exercise the power of imagination.

On the other hand, reading some papers and articles also encouraged me to use

narrative genre and logic in my research study. According to Taylor, Settelmaier & Luitel (2009), narrative genres are used to speak from a lived storied perspective bringing contexts, events and people to the textual space, thereby depicting richly the complexity of human experience. Many cultures bring forth storytelling traditions as a means of knowledge generation, depiction and transmission. Transformative researchers can use their natal cultures as a referent for structuring narratives to communicative research outcomes with their primary audience, articulating a dilemma, a moral tale, or a personal-professional story that paints an holistic sense of being and becoming (p. 8). Thus, I used narrative as genre in the whole research study to depict my teaching-learning practices situating myself as a story teller-researcher (hyphenated) by using my cultures as a referent.

Taylor, Settelmaier & Luitel (2009) further assert that narrative logic promotes thinking grounded in everyday lifeworlds. Storied thinking enables transformative researchers to contextualise their claims within their personal, professional, professional and cultural contexts. Narrative logic cultivates a diachronic vision, a means for conceiving the research process as a chronological evolution of emerging events, research foci and ideas. Diachronic vision helps make events intelligible in relation to what has transpired in the process of inquiry.

Moreover, narrative as genre and logic helped me to portray my lived and living educational contradictions. In my opinion, narrative is a means of expressing one's experiences and practices into textual form so that one can easily present his/her lived world in an intelligible form.

Quality Standards

As a Mathematics education researcher I embraced the critical paradigm before I began writing this research inquiry by taking the social values and transformative

action into account. I know that more or less I have transformed myself into critical

teacher and learner because I have experienced how power imbalances serve as key

sources of social injustice within normative social structures especially how they

give rise to and reproduce habituated behaviours of social groups (Taylor,

Settelmaier & Luitel, 2009). Moreover, openly speaking I strive to generate a

professional praxis aimed at social restructuring, at making a difference by, for

example, working with socially and economically disadvantaged communities to

foster their heightened social conscience, to develop their intellectual prowess, to

enable them envisage a brighter future for their children, to empower them to unify

around a heartfelt commitment, to project an articulate critical voice, and to hone

strategic political skills in order to gain recognition and additional resources with

which to transform their community and, ultimately, the broader society ((Taylor,

Settelmaier & Luitel, 2009). For these all, I had to use critical reflexivity in this

research inquiry as a self-study tool to decolonize my own professional practices of

hegemony ideologies based on culturally decontextualised mathematics education

having been practiced especially in Nepali schools. As a transformative teacher I

have presented narratives to create emancipatory learning environments in which all

students develop their critical conscience and thinking. Then, the quality standard of

my inquiry can be judged by especially critical paradigm which enables me

(probably) qualify as a critical teacher and learner in the days to come.

How can my research be regulated? This is the question raised in me

throughout this research inquiry. Though my inquiry may be judged by especially

critical paradigm, I advocate that my inquiry is broadly judged by the paradigms of

Habermas' two cognitive interests – practical and emancipatory (critical) as I have

presented in the research study that it is my journey of transformation from the

technical interest to that of practical and emancipatory. Moreover, technical interest is grounded on the paradigm of positivism and the quality standards based on positivism cannot judge my research inquiry for the positivistic standards of validity, reliability and objectivity are almost irrelevant for judging the quality of my research process and product (Luitel, 2009). Practical interest is grounded on paradigm of interpretivism and that of emancipatory on criticalism, both of which have regulated my quality standards on the following set of standards which I have described below.

(a) *Research as/for consciousness raising:* Hopefully, my research study report will be helpful in raising my and others' consciousness about the culturally decontextualised mathematics education practiced or being practiced in Nepali schools and colleges. I hope that this report will also be helpful for those students who are victims of mathematics education due to conventional teachings. On the other hand it may be helpful in raising consciousness to the educationists and make at least to think about the changing/reforming of the current curriculum of mathematics in Nepal. Moreover, I hope to have been conscious enough to contextualise the academic (culturally decontextualised) mathematics education in schools in my teaching practices.

(b) *Research as/for professional development:* With anticipation, this research will be helpful for me, all the teachers, educators and researchers to develop their professional development in their teaching learning practices. I hope to have developed my professionalism in my teaching learning practices through this research study. Teaching profession is not just for producing students of predetermined package of pure knowledge like factory products rather we need to produce them as the hope of the present and future with full of knowledge-construction *talents*. For this, my research study can be helpful to encourage me, education practitioners and

educationists for their professional development by using Habermas' practical and emancipatory cognitive interests to contextualise any culturally decontextualised mathematics education in their teaching learning practices.

(c) *Research as/for reconceptualising self:* This research study helped me to discover and develop myself as a teacher. I was not a teacher but just a knowledge passer to the passive recipients. This research study helped me in teaching in a better way when I came to realize that teaching is about facilitating students to construct knowledge freely in their cultural contexts. It also helped me transform to a practical and emancipatory (critical) teacher from that of conventional (technical) one. As a transformed (hopefully) teacher and learner I will be helpful for all the students and teachers in my school under my teaching practices.

(d) *Research as/for socio-political action:* This research study helped me to develop alternative and inclusive thinking about mathematics education. I have depicted in this research report that inclusion of culturally contextualised mathematics in the currently practiced culturally decontextualised academic mathematics education and have discussed about the possibility of inclusion of ethnomathematics. This has encouraged me to practice contextualisation of mathematics through ethnomathematics in my classroom teaching practices. Now-a-days, I encourage my students and teachers to link the academic mathematics to their cultures (Chapter 3) and have designed different projects and programmes in my school so that students enjoy learning mathematics with their cultural values.

(e) *Research as/for pedagogical enablement:* The research texts that I have generated in this research study helped me to be an enabled teacher insofar as teaching mathematics for understanding and praxis is concerned. Leaving behind the disempowering nature of conventional teaching pedagogy, I struggle everyday to

follow empowering approaches of teaching by engaging my students in interaction to construct knowledge and apply it in context through cooperative learning. This research study has helped me to focus my teaching in understanding the meaning ensuring the interest of students in autonomy and responsibility.

Ethical Standards

In my journey of learning and teaching including my research study, I encountered with various people such as my students, teachers, facilitators, educators and known/unknown persons from different disciplines to deal with directly/indirectly. I have no any direct impact on them intentionally hurting their sentiments. Though I was playful in my whole research study to portray my experiences through drama, story, poems, etc., I have used pseudonyms for the places, people, institutions, or whatsoever except my birthplace, schools, colleges and universities.

Moreover, I have situated myself as a critical thinker supported by practical interest of Habermas throughout the research inquiry. In course of research study I had to face many challenges from around and many times I was vulnerable, distracted and hopeless to some extent too. However my culturally embedded soul prevented me from avoidance of self harm because my ethical purpose of working for the victimized or being victimized people is highly pertinent in my research. My personal feeling and emotion aroused during this research study was sometimes merely deformed from being cool and calm but my epistemological considerations and ontological assumptions led me to avoid selflessness so that I could continue working for the hope and future of humanity. Although I know that without having desires of personal fulfillment it is very hard to perform any sort of work, I had to avoid my desire of personal fulfillment for a noble work that I was doing for the first time through this research report. Being embedded with cultural morals and values I abide

mainly by the following two important ethical standards throughout my research inquiry.

a) *Avoidance of self-harm*: I believe that an important ethical standard as an educational researcher is to have courage of avoiding self-harm. Presenting scholarly all my teaching-learning practices and experiences in this research study certainly raised a question in my mind-set. Won't it harm my self-esteem by presenting all my personal wealth openly in this research project? However, my ethical morals and values learned from cultural practices helped me in avoiding self-harm because it was worthwhile for me to carry out such a grand research inquiry.

b) *Overcoming Vulnerability*: Another ethical standard I insist to include here is that after reading this research report some may experience trauma including self-harm and many students and teachers who are victims of culturally decontextualised mathematics education. But my research project seeks perspectives on the responses of the social service and legal systems to victimization of vulnerability. I know that quite often I was vulnerable but this noble work of writing helped me to control my emotions and feelings leading towards a success.

Summary of the Chapter

Overall, this chapter comprises my perception of research pedagogy and methodology. Beginning with my tenderfeet in gaining the perception of research, I walked through the following footsteps: selecting the research topic, locating myself, rationale of study, research questions, theoretical perspective, lila-play, drama, dialog and narrative, quality standards and finally the ethical standards. In the theoretical perspective, I have depicted all the supporting literatures along with the research methodologies. Moreover, in this chapter I have depicted my supportive ingredients necessitated for my research study.

While reading and studying various research books and articles, my personal emotions and feelings were distorted and then shaped, aroused and then settled but what I got from this journey of research study is all about my professional development. I became strong in the part of my professionalism to value the notion of "work is worship". As an M. Ed. Student it is an achievement beyond my thinking and capacity because I had thought that writing thesis in M. Ed. study was just collecting some information and investigating them to give a final form. As a novice researcher I have learnt so many things related to research inquiry which is far from my imagination. Moreover, it aided some to the growing body of research in the area of culturally decontextualised mathematics education by contributing important implications for the transformation of curriculum policy, pedagogical practice and professional development.

Intimate, appropriate guidance of my supervisor Dr. Bal Chandra Luitel, Assistant Professor of Kathmandu University, Nepal and immense, critical comments by my external examiner Dr. Peter Charles Taylor, Associative Professor of Curtin University, Australia both encouraged me to shape this research project so as to serve as an exemplar of cultural studies of mathematics education employing arts-based critical auto/ethnography and philosophical inquiry.

After a wide study of various research papers I could be able to formulate a coherent set of research questions, design an appropriate research methodology, create a powerful theoretical perspective, conduct an insightful empirical study, and present appropriate conclusions and implications. I owe my supervisor Dr. Luitel for such well formatted dissertation. This first attempt of research inquiry has really aroused my hope and shaped my future direction for M. Phil. and PhD studies. I have cultivated the crops of research inquiry in this M. Ed. Study and will continue further

by deepening my research study. Moreover, I got a unique opportunity to enhance the cultural contextualisation of the research methodology by explaining the local cultural significance of Lila-play in this chapter 1.

CHAPTER II

CULTURALLY DECONTEXTUALISED MATHEMATICS: A BASIS FOR

PROMOTING MECHANISTIC RATIONALITY

Mr. X: A Mathematics Teacher

With tranquil heart and mind,

In the diverse environment,

I settled to experience the cool and buzzing breeze!

There comes a flock of birds in the blue sky,

I concentrate on their hustle bustle all along,

Come and go they, distracting me from attention,

Angel comes down on the earth of crops

Follow all and fill the whole milieu.

With bouncing heart and mind,

In the monotonous environment,

I enter to experience the wearisome sermon

From Mr. X guided by orthodox theology

I dream of being fairy and fly in the sky

There comes a demon and webs me whole

"Wake up and tell what I edified all,

You little scaffold" Mr. X howls!

With a stick in his hand, beating knowledge

Into his pupils, Mr. X inhales satisfaction!
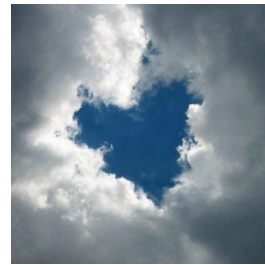
With a bundle of anxiety, carrying a load

Onto my head, I derail from mathematics!

Chapter Overview

This chapter portrays my journey of learning of culturally decontextualised mathematics as a body of pure knowledge (Luitel, 2009) from school to college through informal cooperative learning with friends at home and school. The chapter is fractioned into three episodes of stage show: the episode 1 is fractioned into Act I, Act II and Act III depicting the real situation of Grade six students and their mathematics teacher in teaching-learning process; the episode 2 is also fractioned into Act I, Act II and Act III depicting the real situation of Grade eight, nine students and SLC examination candidates in learning mathematics; and the episode 3 depicts the emergent change in the thinking of a college student about the current education system. Over all, all the three episodes are central to the characters who have been victimized knowingly/ unknowingly in the process of learning mathematics from school to college.

My experience as well as intuition about teaching-learning argues that children are eager to know the answers of the mysterious questions 'why, how and what' about mathematics (Episode 1). Factually, "Understanding happens when learners think about and try to make sense of the world (Killen, 2003, p. 3)". For this, there should be an appropriate environment to be created for the learners and henceforth children will be able to mould themselves into that environment to know the actual meaning of learning something. Moreover, a child first gets the meaning and understanding of mathematics from his/her insight by reading the texts from books and then from classmates and teachers. It is true that mathematics is a form of reasoning. Thinking mathematically consist of a logical manner, formulating and testing conjectures,

making sense of things, and forming and justifying judgments, inferences, and conclusions. We demonstrate mathematical behavior when we recognize and describe patterns, construct physical and conceptual models of phenomena, create symbol systems to help us represent, manipulate, and reflect on ideas, and invent procedures to solve problems (Battista, 1999). Then, to make sense of mathematics, a child seeks for help from teacher; if not, gets distracted from it thereby drops out from school/college. To me, the first candidate to attract students towards mathematics learning is a teacher; if not, then parents, friends and factors involved in his/her surroundings. Certainly, friends can share their knowledge through cooperative learning at home/schools wherever in learning mathematics. Jhonson & Johnson (1993) state that cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning. Within cooperative activities individuals seek outcomes that are beneficial to them and beneficial to all other group members. The following three episodes portray how a student gets frustrated from mathematics and in turn, cooperative learning helps him to taste mathematics learning.

Three characters (Episode 1) "I, Dammar and Hari" are struggling to learn mathematics from their own efforts. The fourth character Mr. X, their teacher seems to be worthless here in the episode to teach mathematics to his students. For the three characters, knowing and understanding of mathematics is to solve the mathematics problems assigned by the teacher; more precisely to find the specific answer to the given problems. They have no idea about 'knowledge construction'. Rather they are just after the algorithm (method/process) of mathematics problem solving. However, neither the teacher nor the students have any idea about mathematics teaching and learning from constructivist point of view. They have no idea that a constructivist

framework does not imply a specific method of teaching learning mathematics as they are doing so. Mr. X has never thought (or have no idea) that investigative teaching is motivated by a desire to develop students' conceptual frameworks in mathematics for which a metaphor of individual *construction* of understanding and its mediation through social interaction is powerful (Barbara Jaworski stated in Bjorkqvist, 1998, p. 6). Mr. X has never tried to find or explain the answers of the questions: What does it mean to *know* multiplication tables, algebra, etc.? What are the images that underpin this knowledge? How can one relate multiplication table with doing algebraic problems? Is there any meaning and logics of asking multiplication table everyday in the classroom even though it is algebraic class or else? No constructivist teachers/learners know it! Rather Mr. X and his students know it as the multiplication table is important from examination point of view. This is how mathematics is totally decontextualised by Mr. X by compelling his students to learn mathematics central to the examination instead of teaching mathematics in contextual frameworks: no social interaction rather one way traffic and just practice and practice!

Above all, I have tried here to put some glimpses about how the following three acts (I, II & III) are going to portray suffer of poor Dammar in learning mathematics poured by Mr. X but supported him by his two friends. Though these three acts conclude with happy ending to convey the morals that Dammar who use to be distracted from mathematics learning is transformed into a mathematics learner to enjoy doing math with the help of cooperative learning accompanied by his two friends, Mr. X is still unknown about how he should teach in the classroom: no idea how mathematics is contextualized!

Episode 1: Experiencing a Culturally Decontextualised School Mathematics Education I

Act I

(The Director makes an announcement that Act I of Episode 1 is going to start soon, briefly explaining to the audience about the nature of the street drama that is to be performed soon.)

Whistle Blows

STORY TELLER-RESEARCHER (Background music is on)

(It can be any day of mid-March, 1982. It was merely 5 p. m. For the last few days I have been practicing mathematics for 6th Grade final exams of mathematics. Today upon my friends' request, I have come to my friend's house to practice mathematics together. When I reach there, already two friends have been practicing mathematics. Dammar and Hari were in a full swing of learning multiplication tables of 12, 13 and 14 sitting on the floor of Dammar's room.)

(Background Music Off)

Nepali version as they are practicing	English Translation
Barah ekan barah	Twelve ones are twelve
Barah duna chaubis	Twelve twos are twenty-four
Barah tiya chhattis	Twelve threes are thirty six
Barah chauka adchalish	Twelve fours are forty-eight
………………………………..	…………………………

(Actually, we are here for solving difficult problems of mathematics but I am stunned from their hustle act of learning tables. Anyway, they pause suddenly. We sit in three sides facing each other; books are at the centre.)

Dammar: Why did you come late? (Pause) Don't you know?

I (startlingly): What? Is anything wrong?

(I know that our math teacher Mr. X is very sincere about asking multiplication tables. With a stick in his hand, he asks the tables in the class whenever he wishes to. Is it what Dammar is exly talking about?)

Hari (carelessly): Mr. X will destroy us tomorrow?

I (shockingly): What?..Why?

Dammar (smiles): Ah! It's just…he will ask us the tables of 12, 13 and 14? You were absent today. He has…(*Intercepted*)

Hari (hurriedly): These tables are important for final exam, he said….So, he will ask them everyday from tomorrow.

I (curiously): Is it so? Why are you all so frightened then? Don't you know these tables?

Both (one voice): You know?

I (confidently): Of course! But a bit confusion in 14!

Both (one rhythm): O…….h!

I (patiently): Ok, then let's learn the tables for some time and do multiplication of decimal numbers, ok?

Both (one voice): Ok. That would be fine!

(All of us start our rhythm of learning tables…walking here and there…..After about 10/15 minutes we settle down and start asking the tables to one other. Dammar and Hari are still in dilemma but I am not. I have learned all the tables up to 15 the whole

day as I did not go to the school today. I have only some confusion in 14. Dammar is bit nervous to attend tomorrow's class as he still doesn't know the tables above 8.)

Dammar (furiously): Ummh…! I think I won't go tomorrow?

I (carelessly, although I know what he means by that): Where?

Dammar (with hopelessness): School.

Hari (showing concerns): Leave it, Dammar. Learn it tonight and go to school tomorrow. Final exams are coming near…. Mr. X will teach us important questions.

I (with sympathy): He is right. You don't worry, Dammar. Better get ready to get some sticks but do not remain absent as I did today.

(He nods his head. After a while, we sit for problem solving. The sun has already gone down the horizon. Darkness has blurred our visibility. Dammar goes into the kitchen and comes with a kerosene lamp. We then start the multiplication of decimal numbers. I and Hari do some but Dammar is still in the first question.)

Dammar (very nervous): I couldn't….(paused). How did you both know?..But why couldn't I?

I (taking Dammar's exercise book): Let me see your solution. (After a few seconds) Here is the mistake. See, you have written '9 sevens are 56' but it should be 63.

Dammar (nervous): Oh! I think without learning table I could not solve these problems.

Hari (comes forward with the solution): Don't worry, Dammar. See the table and do the problems now. Later at night you learn it.

I (excitedly): Very good idea! Yes, Dammar. Now do it from the beginning!

(After half an hour, Dammar asked a tedious question)

I				II			
8 • 6	7			8 • 6	7		
× 5 •	9			⊠ 5 •	9		
7 8 0	3			7 8 0	3		
4 3 3	5			4 3 3	5	⊠	
1 2 1 • 3 • 8				5 1 • 1 5	3		

Dammar: Once have look at it. Shall we put the

decimals at two places like this? (Fig. I)

I (astonished): Oh, my god! How could you do so?

Hari (laughs and adds mockery): Ha ha….! Were you sleeping then when Mr. X was

teaching?

Dammar (annoyed): Ah! I couldn't understand what he taught!.... goes really too fast!

I (showing my solution, try to explain him): Look! This is the right solution. (Fig. II)

Hari (intercepts me): Yeah! You don't know how to place the decimal? My goodness!

I (explain as I was taught by Mr. X): Look, count the numbers in the right side of each

decimal… one, two and three. Now count the numbers from right to left in your

answer….One, two, three and put the decimal here. Got it?

Dammar (acceptance is seen in his face): Ah! I got it! Thank you, friend! Thank you

so much!

Hari (earsplitting voice): Wait! Look at this, where he has placed 5? (Fig. I, positions

of digits inside red-marked rectangle)

I (dumbfound): Oh, my god! You don't know this too?

Dammar (denial): Ah, sorry! I know but… Anyway, it must be like yours. I was

nervous.

I (patting on his back): Good! Take it easy, Dammar. You have to practice a lot.

Dammar: Can you tell me why this cross sign is given here? (Fig. II, he is indicating

the cross just below 3)

I (confidently): Mr. X has told us to put cross sign always below the first number in

the second row, yeah!.... Understood!

(He nods his head. Hari was busy in doing problems)

Dammar (eyes wide-open): Then, why don't we multiply here as we do up here?

(Dammar is trying to understand the different meaning of same cross sign placed at two positions) (Fig. II, cross signs inside the red-marked rectangles)

Hari (intercepts): Uh! Why do you always ask, why and how? Irritating!

(Murmurs).... Learn how to do, friend! Exam is near. Don't know any and ask why and how! Pack up for tonight! It's already time for dinner. My mom will shout at me if I am late.

(Hari packs up. I console Dammar and suggest him to practice whole night rather than finding the answers of how and why. I also go home to sit together tomorrow again)

(Background Music On: Whistle blows and street stage light is off)

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Act II

(The Director makes an announcement that Act II of Episode 1 is going to start soon, briefly explaining to the audience about the nature of the drama that is to be performed soon.)

Whistle blows

STORY TELLER-RESEARCHER (Background music is on)

(The class room is very hot. The roof of the room is terribly blessing heat to us. We are waiting for Mr. X to come into the classroom. I can see Dammar's faded face. He can foresee the consequences which will be resulted in short a while. The bell has already gone. It's already five minutes. The pupils are learning the multiplication table. And....pin-drop silence in the classroom! Mr. X enters the classroom.)

Whole class (stands and greets in one voice): Good morning, sir!

Mr. X (commanding voice): Good morning class. Sit down!

(Mr. X puts his chalk and duster on the table, holds his stick and walks front and back in the classroom.)

Mr. X (arrogant voice): Did you learn the tables?

Whole class (one voice, loud): Yes, sir!

Mr. X (loudly): I can't hear you!

Whole class (extremely loud): We have learnt, sir?

Mr. X (stares at one student for a moment): Ok. Then, you get up! Tell the table of 14.

Dammar (stands, fades away with fear): Ummh! 14 ones are 14, 14 twos are 28, 14 threes are 42, 14 fours are 56, 14 fives are 70, 14 sixes are 84, 14 sevens are…14 sevens are…..

Mr. X: What happened? 14 sevens are what? (Hits his stick hard on the desk)

(Everyone in the class is frightened. Chaotic environment! Dammar holds his head low.)

Mr. X (cuffs): You disgusting fellow! Didn't you learn it at home?

Dammar (quiet): ……

Mr. X (shouts loud): You filthy, stupid monkey! Neither you learn, nor let others do! I know you are the only one in this class to make a noise in absence of teachers. You are good for nothing except playing all the time, yes? (Long breath) And you never pay attention to the class while the teachers are teaching… Stretch your hand, you rascal! (Dammar stretches out his left hand) You will never learn good things, Dammar.

Mr. X (with anger): Both.

(Dammar stretches his both hands, shivers. Mr. X hits five sticks in each. Dammar sobs and presses his palms each other to mitigate his pain)

Mr. X (shouts): Tomorrow again. You got me?

Dammar (with great agony and sobbing): Yeah…yes sir!

Mr. X: Now sit down! (Engaging the whole class) Listen to me you all carefully! Learn the table up to 15 or be ready for the same consequences.

(About 15 minutes of 45 minutes long period have already passed. I can see Mr. X calming down while Dammar is still sobbing and massaging his palms. He asks all students to take out the book and turn the chapter Addition and Subtraction of Algebraic Expressions. Mr. X writes one question on the board and looks around the class. The question is given below)

Question. Add: $3x^2y - 4xy + 2xy^2$, $4y^2x - 5yx + yx^2$ and $-4x^2y - 7xy^2 - xy$

Mr. X: Who can do it? Raise your hand. (Nobody raises their hands.)

Mr. X (shouts): Nobody! This all rubbish! I have already taught you the questions like this and you don't know it? (Looks at me) Ok, Indra, come and do it on board.

I (heart beats faster): Ok sir.

(I go to the board and start doing and the answer comes)

Mr. X (pats on my shoulder and shouts at others): Did you understand?

Whole class (one voice): Yes, sir.

Mr. X: Can you do it again?

Whole class (one voice): Yes, sir.
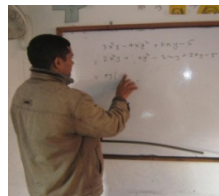
Mr. X: Then do it on your own exercise book. (He rubs the solutions)

(The whole class is now busy in solving the questions. I also do the same. Dammar is not able to catch the pencil properly. His hands are still shaking. I try to help him in solving the problems because he was not collecting the like terms together. He is in puzzlement to find the like terms as they are disorderly given e. g. x^2y and yx^2, xy and yx, xy^2 and y^2x. Mr. X is sitting on the chair in the front and informing us that this question is very important for the exam.)

Mr. X (stands suddenly): It's time for the bell. Hurry up!.....Didn't you complete? Stop! Complete it at home. See the book and tick the questions for homework.

(He gives some question numbers selectively and the bell rings for lunch break. Mr. X leaves the classroom. Whole class stands to greet him and comes out one after another for lunch. Dammar does not want to come out but I and Hari convince him. Finally, we come out and go to the ground. It is hot sun. Hot wind has begun to blow. So, we choose a corner of the ground under the shade of a tree and sit. We take out our lunch from boxes and start it.)

Hari (dishonestly): This teacher is like animal…very dangerous!

I (looking at Dammar face): Yeah but what shall we do, friend! If you don't know what he asks, your will be paid severely like he did it to you.

Dammar (still fearing): It was so hard, friends! Uh! He hits with no mercy!

Hari (chewing the bread): Didn't you learn it last night after we separated?

Dammar: Ah! I was learning it lying on the bed. I don't know when I slept. When I woke up, it was already 7 in the morning.

Hari (carelessly): That's it! You are paid! We told you to learn last night. You are a lazy bone.

I (passionately): Leave it, Hari. He will do it tonight.

Dammar (hopeless): No friends! I can't do it. This math is the hardest of all. Very difficult to digest!

Hari (humorously); Yeah, it spoils your stomach and runs it. Ha ha….

Dammar (serious): It's not funny, Hari. I am serious. Whatever effort I give on it, I can't help myself. Neither my father could do it, nor can I.

I (pat on his head and console him): No, Dammar. My father also doesn't know mathematics but I can do it and mathematics is my favourite subject.

Hari (agrees with me): Mine too. (He is busy in chewing stuffs)

Dammar (stops eating and signifying me): You are talented, Indra and you too, Hari. But my brain is like sheep's.

I (change the scenario): Dammar, leave it. Finish your lunch. We had our already!

Hari (stands): You guys stay here. I've got to go to the tube-well for drinking water.

I (consoling): Dammar, I tell you one thing truly, don't take it either. Ok?

Dammar (astonished and looks at me): Ok.

I (very passionately): Actually, I agree with Hari that you are lazy, friend. If you don't work hard, you can't get a success. My father always says it and he always asks me to study hard every time and I do it. But you know, I usually find you playing marbles and balls and you just study before the exam. I also agree with Mr. X blaming you today.

Dammar (takes a long breath); Yes, my friend! You are right. But I hate math!

I (agreement/disagreement): Yes, but you must study to prevent yourself from Mr. X.

(Hari comes back. We walk along the ground. The bell rings. We go to our class)

(Background music is on: Whistle blows slowly and stage light is off)

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Act III

(The Director makes an announcement that Act III of Episode 1 is going to start soon, briefly explaining to the audience about the nature of the drama that is to be performed soon.)

Whistle blows

STORY TELLER-RESEARCHER (Background music is on)

(After school, I take bath at home and get ready for group study at Dammar's house. When I push the door, I find Dammar lying on his bed in the hot, dark room as he has

closed all the windows. I open the windows. The wind blows gently and creates a tranquil atmosphere in the room. Hari hasn't arrived yet. It's already 4:30 p. m. The outer atmosphere is playing a hide and seek game-the sun comes and goes, clouds are moving hither and thither in the sky, rain is about to burst into the planet. And the room swiftly becomes gloomy. Dammar gets up and fetches the lamp and lights it up. Hari enters.)

Hari (sitting on the mat): Hi friends! Sorry, I'm late. (Long breath) Uh! Going to rain outside! ….You have not started?

I (sit on another mat): No, not started! Dammar was sleeping when I came here.

Hari (humorously): The taste of Mr. X is still on you, Dammar! Poor fellow!

Dammar (annoyance): Huh! Don't be funny always.

I (subjective): Let's get into the matters!

Hari: Ok, we do math homework.

Dammar (carelessly): But I will do others. I am not in my frame of mind to do Mr. X.

Hari (immediately intercepts): Why, Dammar? Don't go after Mr. X, my friend! He is just like that. You do your business, he does his own.

I (settling the arguments): Clam down, friends! We do our math homework. Dammar will do his. (Rupture sound is heard from outside) It rains! Close the windows. (Dammar closes the windows and sits back) Dammar, what did you decide, math or others?

(Dammar is quiet for some time. Hari starts doing math homework. I keep on counseling Dammar. Ultimately, he agrees to do math homework)

Dammar: Ok, explain me today's math question.

(I explain him how to find the like terms and collect them. I solve the question explaining whatever he asks but he was inquisitive to know about the application of Algebra in our real life situation)

Dammar (frustration!): Why do we study Algebra? Always, x, y, z,....a^2, b^2, … irritating!

I (hypothetically): Because it will be helpful in future studies, I have heard from seniors.

Dammar (curious): Do you find where we use algebra in our daily life? Arithmetic is used but this Algebra?

Hari (annoyance): Oh, god! This fellow is horrible, Indra! You first study, later it will be known, Dammar. Mr. X has described you clearly today in the class. We can't get all the answers of how, why and what in class six. When we become mature, all will be known. Do you think that a child knows everything of this world? Uh! It's horrible!

I (agreement with Hari): I agree with you, Hari. Dammar, I also think as what you think about Algebra. I also do not find its use in our current life. But our seniors tell that algebra has great application. How and where, I don't know.

Dammar (convincingly): Ok, I think so. Probably, it will be helpful in future.

Hari (hilariously): You just open your eyes. Now with no delay, learn to do math; otherwise, with no mercy Mr. X will smash you tomorrow.

(All of us start to do our math homework. I can see dammar is trying to do the problems. Every single moment he looks at my solutions. He has no confident in Algebraic problems. There comes across a question. Dammar gets stuck on that. He tries to solve but he can't. He does and cancels and repeats the same. He then throws his exercise book and murmurs)

Dammar: Oh, god! Who invented this Algebra? I am helpless. I can't do it.

Hari (serious concern): What happened? Oh, Dammar! (Collects Dammar's exercise book) Take it. Where is the mistake? Don't be silly. Come on! I will teach you. (He solves the problem with explanations. Dammar argues why that happens, why not that. Actually Dammar is stuck in one step which is very simple thing to be known but he doesn't. The question and its solution look like as follows:

Question: Add:

$4a^2b^2 + 3a^2b - 5ab^2 + 3, 4ab^2 + 3ba^2 - 5b^2a^2 - 4, a^2b + 3a^2b^2 - 5ab^2 - 6$

Solution done by Dammar:

$(4a^2b^2 + 3a^2b - 5ab^2 + 3) + (4ab^2 + 7ba^2 - 5b^2a^2 - 4) + (a^2b + 3a^2b^2 - 5ab^2 - 6)$

$= (4a^2b^2 + 3a^2b - 5ab^2 + 3) + (4ab^2 + 7a^2b - 5a^2b^2 - 4) + (a^2b + 3a^2b^2 - 5ab^2 - 6)$

$= 4a^2b^2 + 3a^2b - 5ab^2 + 3 + 4ab^2 + 7a^2b - \boxed{5a^2b^2 -} 4 + a^2b + 3a^2b^2 - 5ab^2 - 6$

$= (4a^2b^2 + \boxed{5a^2b^2 -} 3a^2b^2) - (3a^2b - 7a^2b - 5ab^2) + (3 + 4 + 6)$

= …………………………………………………….

(He finds the answer but does not match with mine. That's why; he has thrown his exercise book with annoyance. He has actually done mistakes in sign-operations. He thinks that a term contains the sign just after it e. g. sign of $4a^2b^2$ is + as it is just after it on the right side and sign of $5a^2b^2$ is – and so on. It is noticeable when I see $(3 + 4 + 6)$ instead of $(3 – 4 – 6)$. When we ask him about its reason, he explains it briefly and clearly. In the beginning I am also stunned and think that he is right but I am confident because I am able to find the correct answers by following the process of Mr. X.)

I (stunned): How did you do this? Who taught you this method?

Hari (funnily): Maybe, his god? Ha ha…. Poor fellow!

Dammar (confidently): I use my intuition and conscience.

I (surprised): What did you learn when Mr. X taught it us?

Dammar (careless): You know, I hate math and I usually don't listen to him in the class. Sometimes I dream while he is teaching.

I (consolation): I think, you must study math very seriously. Otherwise you will never learn it in your whole life.

Dammar (acceptance): Yes, Indra! From today onwards I will start it but help me, ok?

I (excited): Sure, why not!

Dammar (to Hari): And you!

Hari (doing problems): Of course, I will also help you.

I (rejoice): I am happy, my friend. But work very hard. Stop playing from today, ok?

(Dammar promises that he will study very hard and won't spend his time in playing. When we see outside, the rain has already stopped. I hear Dammar's mother calling for dinner. I and Hari also rush to our houses as it was already 7:15 p. m.)

(Background Music On)

(Since then, Hari becomes rigid in his promise. He works very hard day and night. Gradually he improves his problem solving skills. He never gets stuck on the questions "why, how and what". He always follows Mr. X. and Mr. X also gets surprised from his gradual improvement (!). His parents, neighbours, friends and of course, Hari and I, all have a kind of respect for his hardworking passion and love him very much. Now he does not say, "I hate math!" Rather he says, "I enjoy doing math!")

(Big round of applause from the audiences. Curtain falls slowly and stage light's off)

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Episode 2: Experiencing a Culturally Decontextualised School Mathematics

Education II

Act I

(The Director makes an announcement that Act I of Episode 2 is going to start soon, briefly explaining to the audience about the nature of the drama that is to be performed soon.)

Whistle Blows

STORY TELLER-RESEARCHER (Background music is on)

(It can be any day of Last week of May, 1983. It is the second month of my Grade Eight journey. Since I was admitted to a new secondary school which is at half an hour walk from my house, it is completely a new environment for me. I am the second ranked boy from the previous Lower Secondary School and I have to compete here with the first boy in this new school. The teachers usually ask me some questions in course of their lecture. I usually reply: it may be right or wrong. But I have to study theorems in Geometry here in class eight. In the beginning, I did not understand anything of theorems neither from the teacher nor from the book. For the first time I encountered with theorems and I felt as if a lion was roaring at me. Some days back, one of my classmates introduced himself to me as *Shikhar*. Since then, we sit together and do math problems. He is smart in Geometry while I am in Arithmetic and Algebra. We make plans how to learn from each other. Lunch time and leisure periods when the teacher remains absent are our target. Today, Nepali teacher is absent in the fourth period, we are together to discuss about theorems. He is going to teach me the first theorem for me: Sum of all angles of a triangle is always two right angles"

He has already taught me the basic things before we start theorem in the class and I have learnt them in a regular basis at home and school. I am command in those things such as

(i)   Sum of two adjacent angles in a straight line is two right-angles.

(ii)   Sum of more than two angles in the same straight line is also two right-angles.

(iii)   Corresponding angles formed by a transversal with the parallel lines are equal.

(iv)   Alternate angles formed by a transversal with the parallel lines are equal.

(v)   Sum of two co-interior angles formed by a transversal with the parallel lines is 180^0.

(vi)   When two straight lines intersect each other, vertically opposite angles are equal.

Although I have no idea of the proofs of the above theorems, I have learnt them and have understood their meaning because before Shikhar became my friend, the teacher has already taught their proofs. I am excited today and waiting for the fourth bell. The bell rings and the teacher goes out. We take out our math books and exercise books.)

Shikhar (with commanding voice): Indra, now look at here. I am going to prove this theorem. I am your teacher and you are my student. (Smiles gently)

I (response with smile): Ok, sir.

Shikhar (humorously): Good boy!..Ok, listen to me carefully! (Explains as well as writes on my exercise book) Theorem contains five components: Figure, Given, To prove, Construction (only if necessary) and Proof. The proof has two sub-components: Statements and Reasons. (Takes a long breath)

I (quiet but attentive): Ok, explain what they mean.

Shikhar (suggestion): Do not hurry, just listen to me carefully. You can ask me if you do not understand. But you need to concentrate. Listen! At first, read the statement of the theorem carefully and understand what it says. Then draw an appropriate figure with the help of pencil and ruler……. We have a triangle, yes?

I (quickly response): Yes.

Shikhar (pats on my shoulder): Then draw a suitable triangle and give any name to it. Let it be ABC. (He draws a triangle)

I (curious): What type of triangle, isosceles, equi…?

Shikhar (Interception): Any type but suitable.
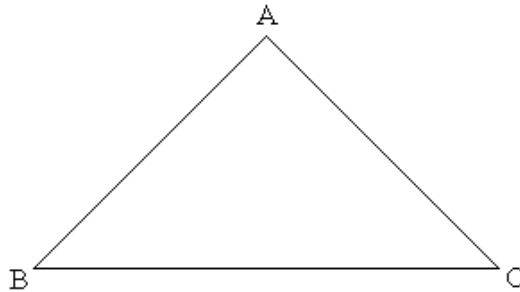
Shikhar (continues): Here is it! Now we have to write in the Given section. Write the facts given by the statement of the theorem with the help of symbols you have used in the figure. Like, there is a triangle; we have to prove the relation among its angles. So we write as:

Given: ABC is a triangle in which BAC, ABC and ACB are three angles.

I (engrossed): I am getting it clearly.

Shikhar (commands): Good but just keep listening very carefully!

I (acceptance): Ok sir!

Shikhar (smiles): Now we need to write in the section To prove! What does the question ask to prove? Do you know?

I (gentle reply): Sum of angles is 180^0.

Shikhar (pats on my back) Very good, my friend! You got it. Then write it with the help of symbols as

To Prove: $\angle BAC + \angle ABC + \angle ACB = 180^0$

Shikhar (continues): Now you have to seek for help if necessary. It is just like you take help in doing any problem if you can't do yourself. If you can do yourself, you don't need any help. As similar, if you need help to prove theorem, take it; otherwise leave it and go to the Proof next.

I (anxious): How do I know that I need help?

Shikahr: That's the matter here! For this, you have to go back to previous definitions, theorems and corollary. Find the similar ones from there and apply in the theorem. Now recall them and tell me which one is similar to this theorem.

(I close my eyes for a moment and go back to those stuffs. I encounter with the one an dtell him immediately)

I (confident): I got it. Is it, sum of two adjacent angles in a straight line is 180^0?

Shikhar (smiles): Yes, but tell me more accurate one. Recall! Hurry up! Time is running out. It's time for the lunch bell. (I again go back for some time)

I (excited): I got it! Sum of more than two angles in a straight line is also 180^0. Isn't it?

Shikhar (smiles): Very good, Indra! How do you think that why this is apply here?

I (passion): My intuition tells that it must be useful because there are more than two angles in a triangle.

Shikhar: But they are not in a straight line!

I (furious): That's what I am thinking about!

Shikhar (strikes at the central point): That's what we have to draw in Construction, Indra?

I (Long breath): O…..h! It means we have to draw a straight line. But where?

Shikhar: Hit and trial method. Try here, here or here. (Shows the possibilities)

(I concentrate into the figure and guess it)

I (guessing): Is it through A?

Shikhar (pats on my head): Yes, but what type of straight line?

(Bell rings. It's lunch time. Everybody is out for the lunch. But we walk towards toilet discussing the type of straight line to be drawn. He doesn't tell me; instead he asks me to find it. I concentrate. After a short toilet, we come back discussing into the matter. Since we usually take our lunch in the morning at 9 a. m. at home and go to the school with some snacks (bread, fried corns whatever available at home) and share between us. But both of us have not brought it today. So after drinking water from the tube-well we go straight to the classroom and utilize the break time for study)

Shikhar: You couldn't find it?

I: Yes, I couldn't!

Shikhar (smiles): Look here in the figure. If we draw parallel line, being alternate, this angle is equal to this and this is equal to this. But This angle plus this plus this is equal to 180^0. Now replace these two angles by these alternate angles, the theorem is proved.

I (exciting): O…h! Amazing, Shikharu! It's wonderful! I have never thought that theorems are so easy to prove!

Shikhar (interception): Wait, wait! Don't get much excited, we are still left the main body of theorem- the Proof section. Before that, we draw the parallel line. (He draws it)

Shikhar: Here is it. We give its name MN.

Construction: Through A, a straight line MN is drawn parallel to BC.
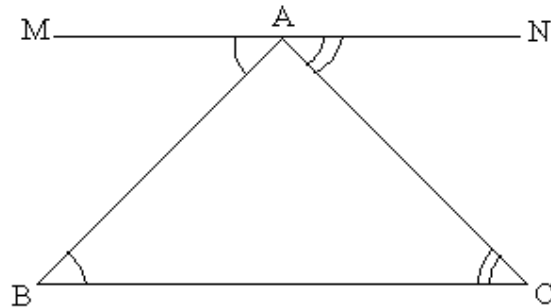
Shikhar (continues): As I told you that $\angle MAB = \angle ABC$ and $\angle NAC = \angle ACB$.

Further, $\angle MAB + \angle BAC + \angle NAC = 180^0$. Reason, you know, yes?

I (acceptance): Yes, I know! Go on!

Shikhar (continues): Next, replace $\angle MAB$ by $\angle ABC$ and $\angle NAC$ by $\angle ACB$, you

get your desired result.

I (excited); Thank you very much, Shikhar!

Shikhar (concludes): Ok, now we tabulate it as follows:

<u>Proof:</u>

S. N.	Statements	S. N.	Reasons
1.	$\angle MAB = \angle ABC$ and $\angle NAC = \angle ACB$	1	Being alternate angles as MN // BC by construction
2.	$\angle MAB + \angle BAC + \angle NAC = 180^0$	2.	Sum of angles in a straight line $= 180^0$
3.	$\angle ABC + \angle BAC + \angle ACB = 180^0$	3.	From statements 1 & 2

<u>Conclusion:</u> Hence, it is proved that the sum of angles of a triangle is two right-

angles.

I (question): Shall we have to write the conclusion?

Shikhar: Better to write.

I (rejoice): Thank you very much, Shikhar! I owe to you! Now I got the central idea of proving theorems. I will practice others at home and explain to you.

Shikhar (smiles and pats heavily on my back): You're welcome!

(Background Music On)

(I take a long breath. I am the happiest person in the world today. We pack our books and get refreshed. The bell rings. Lunch break is over. All the students fill the classroom in no time.)

(A long blow of whistle and stage light's off)

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Act II

(The Director makes an announcement that Act II of Episode 2 is going to start soon, briefly explaining to the audience about   the emergent nature of the drama that is to be performed soon.)

Whistle blows

STORY TELLER-RESEARCHER (Background music is on)

(It can be any day of latter part of April, 1984. It is the beginning of Grade 9. Today all the students who have chosen Optional Mathematics are gathered in one small room just after lunch in the fifth period. I can count twenty students altogether in the classroom. I am sitting with Shikhar and Buddha on the same bench in the front row. The whole class is eagerly waiting for the entrance of the teacher for our first class of optional mathematics.

I want to go a few days back. There was a bit drama with me in the last few days. Five days ago, the Headmaster of our school sent a notice to all the Grade 9 students to register their names for Optional Mathematics. The teacher had already highlighted its

usefulness in the field of Science and Technology and had convinced to choose

Optional Mathematics to those students who are smart in mathematics especially from

Roll Number 1 to 20 (students' names are ordered in descending order of their

obtained marks). I was in dilemma because I had got some information that Optional

Mathematics is a very hard subject. I was seeking for a friend from my neighbouring

area so that he could be helpful in practicing it together at home. More precisely, I

was not confident enough to choose this subject. There was only one friend Buddha

who could take it if he was convinced. I do have my close mate Shikhar who can be

helpful in school time. He is much excited to choose it because his elder brother has

convinced him that Optional Mathematics helps us to join Science Faculty after SLC

(In Nepal science subject is given most priority because most of the parents think that

it is a gateway to a doctor/engineer). My father has no idea about it because he is self

literate person. Only he knows is that I have to study "Science, Mathematics and

English" because he knows their importance in future provided by his friends working

in British Army. As the teacher has suggested us that Optional Math students have to

study harder than others, I made up my mind to convince Buddha. After a long effort I

could convince him and now I have company of two friends- Shikhar in school and

Buddha in near house. That's why; we three are sitting together in the classroom.

My heart beat is bouncing rapidly. And the most awaited time has come. The teacher

enters the room with a gentle smile on his face.)

Whole class (stands and greets): Good afternoon, sir!

Teacher: Good afternoon class! Sit down, please! Welcome to the Optional

Mathematics class, my mathematicians! How are you feeling?

(The whole class takes their seats. No one speaks. Everybody whispers to each other.

The teacher asks the first boy.)

First boy: I am feeling great, sir!

Teacher (gives a lecture): Ok, it is an opportunity for you all to become a junior mathematician. (Keeps smiling) Study hard from the beginning because this subject is completely new for you all. Most of you think that it is a hard subject. You think so, why, you know!.... Because you have never studied it before and it is new for you! (Instant pause) Later on, I am sure, you will find it as the most interesting and favourite subject for you. One important thing, never forget that it is a different mathematics and mathematics is to practice; so you must work hard day and night. It is just a matter of practice and practice……

(The whole class is quiet. Pin-drop silence! Listening to the teacher very sincerely! My confidence is now mounting and the heart slows down to normal. The teacher continues his lecture for about five more minutes; stops and takes a long breath.)

Teacher (continues very passionately): I think you all got my points. Now, please take out your books and turn the chapter "Trigonometry".

(The whole class is now ready for his teachings. The teacher writes the topic "Trigonometry" on the blackboard and explains its meaning. He draws a right-angled triangle and tells how to represent the acute angle (angle of reference) by any of the symbols like theta (θ), beta (β), alpha (α), etc. and the three sides by perpendicular (*p*), base (*b*) and hypotenuse (*h*). He then writes the Pythagoras formula. After that he begins to define six trigonometric ratios: sine, cosine, tangent, cosecant, secant and cotangent. He then explains how the six trigonometric ratios are obtained and writes them as follows with the help of right-angled triangle:
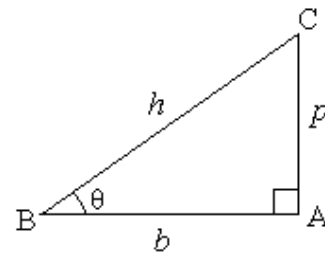
$$Sin\ \theta = \frac{perpendicular}{hypotenuse} = \frac{p}{h} \qquad Co\sec \theta = \frac{hypotenuse}{perpendicular} = \frac{h}{p}$$

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

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

Finally, before enclosing today's class, he gives how to memorize the six formulae as

follows: "*pandit badri prasad hari hari bol*"

sin	cos	tan
(p)andit	(b)adri	(p)rasad
(h)ari	(h)ari	(b)ol
cosec	sec	cot

Pythagoras
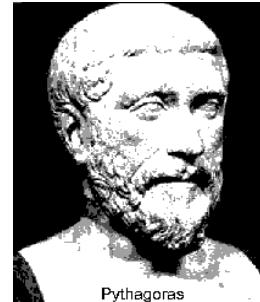
Bell rings. The teacher gives us to memorize all the formulae for homework and

leaves the classroom. The whole class stands and greets for his departure. Our

conversation starts.)

Shikhar: How do you both feel?

I (happily): I feel great, friends! I understood.

Buddha (heavy-heart): Fifty-fifty!

I (surprising): You mean it?

Buddha (furious): I think it is hard, friends. In the first class, I am fifty-fifty, in next

classes, it will be hundred.

Shikhar (interjection): No, friend. It is not hard as my brother told me. Tonight,

memorize all the formulae at home and then decide, ok?

I (convincing): Yes, Buddha. We can do it. We will learn it tonight at home the whole

night. I will help you. Common guy!

Buddha (with heavy heart): Ok! But one thing to say, this math is completely different

from our compulsory math, isn't it?

I (agreement): Of course! There we do the problems related to area, volume etc.

Shikhar (disagreement): No, my friend! My brother has told me that Pythagoras has discovered it when he was, most probably, playing with solid figures as a carpenter does.

I (curious): But how?

Shikhar: So far as my brother told me, he (Pythagoras) measured the sides of right-angled triangular plane wood and find the relation $h^2 = p^2 + b^2$. One more thing, he fitted three squares on three sides of that triangle and calculated their areas and got this result.

Buddha (excited): Interesting!

I (excited): Me too! Can we do it at home! But will you explain it more?

(Shikhar draws a right-angled triangle of sides 3 cm, 4 cm and 5 cm)

Shikhar (pours his knowledge): Look, these three are all squares.

This stands on hypotenuse of 5cm long, so its area is $5^2 = 25$ cm^2.

Similarly, this square is on perpendicular 3 cm, so its area is $3^2 = 9$

and finally this square is on the base 4 cm; its area is $4^2 = 16$. Now add, $9 + 16 = 25$

and it results in $3^2 + 4^2 = 5^2$. It means $p^2 + b^2 = h^2$.

Buddha (astonishment): Miraculous, Shikhar! You are great!

I (curious): I am enjoying learning it, Shikhar. Can it be

possible for other right-angled triangles?

Shikhar (Continues): Of course! It is true in all. You can try

for the right angled triangle of sides 6, 8 and 10.

Buddha (serious): But our teacher did not tell. Shikhar, you knew it from your

brother. We have nobody at home to teach all these and the teachers do not teach us

here at school. I am confused.
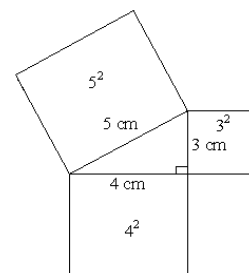
I (agree): That's true.

Shikhar (adds more): You know, we can relate optional math to our real-life situations. My brother is an engineer. He always tells me how optional math is applied to our life.

(The teacher enters. We stand to greet him…. In the evening, I sit with Buddha to learn all the formulae. We all the three are able to continue our group learning for few days. But after a week, we are now only two since Buddha quits from learning optional mathematics. Moreover, only 14 students are left in optional mathematics)

(Whistle blows and stage light's off)

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Act III

(The Director makes an announcement that Act III of Episode 2 is going to start soon, briefly explaining to the audiences about the nature of the drama that is to be performed soon.)

Whistle Blows

STORY TELLER-RESEARCHER (Background music is on)

(It could be any day of Mid-December, 1985. All the class students are preparing for the up-coming SLC examination which is to commence in about one month later. We reside at the sister's house which is about a kilometer far from the exam centre. I stay with my friends Shikhar and Buddha in a spacious room. Since the time Buddha left optional mathematics, he was derailed from the right track of mathematics learning. He just managed to pass class 9. Now he is under our shelter to pass the so-called iron gate-SLC examinations. It is a cold winter morning. We all are wrapped up ourselves with warm blanket. Our books are scattered hither and thither. The famous song of

Nepali film "*Kusume Rumal*" is entertaining us from the radio outside near the house, "*Maya ko bari maa priti ko phula, samali rakheko kusume rumal….kusume rumal, kusume rumal…*")

Buddha (romantic): How beautiful this song is! I witnessed the film.

Shikhar (concerns): Casual boy! Focus on study!

I (agreement): Buddha, he is right. You must practice math now. Do those important questions I have ticked in your book. We will do optional math.

Buddha (murmurs): Bookworms!

Shikhar (annoyance): You will see after SLC result. (Looking at me) He should not be here with us. Disturbing creature!

I (urging): Please…both of you stop! And you Buddha, do your job, will you! By the way, you have to pass; otherwise your father will smash you.

Buddha (careless): I will. I won't have to get first division like yours. Just pass or second division.

Shikhar (ironically): Monkey neither builds its house nor let others do. Aimless and shameless!

Buddha (impulsive): Don't you be over smart, Shikhar! Now-a-days, you are selfish. (A chaotic atmosphere in the room, I ask them to stop all. Buddha goes out)

Shikhar: I have informed you that he is not the previous Buddha. He has left his track. He watches films, smokes a lot and runs after girls. He is not of our kind, Indra. You did a blunder sheltering him with us.

I (guilty): I know, Shikhar but his father has asked me to look after him so as to make him pass the SLC examinations. You know, I can remember he diverted himself from the time when he dropped out from optional math.

Shikhar (serious): Whatsoever! It's not the time of argument! How can we help him at the cost of our time and everything? Look, it's the SLC exam, friend! And he is romantic, insincere and disturbing us. Perhaps he is jealous of us.

I (dilemma): What to do, Shikhar then?

(Buddha enters the room. He goes near Shikhar and sits there. He envelopes in a warm blanket)

Buddha (apology): I apologize, Shikhar for my misbehaviour. My intention was not that and I would not repeat it again. You are a good friend of mine, Shikhar.

(Shikhar keeps quiet and just continues practising optional math problems.)

I (anger): You are very irresponsible person, Buddha. Upon your father's request, I have sheltered you here so that you can learn from me and Shikhar. Don't you know that! Now come to the point and do not disturb us any longer.

(He remains silent and slowly opens his book. We practice our optional math problems. After some hours of practice, my sister calls us for the lunch and then we come back to the room again)

Shikar (cool): Buddha, I am also sorry for saying some bitter words to you. You know that we must do our work according to time and situation and it's time for the SLC preparation. After the SLC, we can enjoy watching films and have lots of fun.

Buddha (clam and concern): I am also sorry, Shikhar. I don't know what happened to me that time but I didn't mean it, my friend. I know how helpful you both are to me!

I (pleased): Very good boy! (Pat on his head) Now let's continue!

(We continue our practice session number 2. But Buddha was not concentrating on study. He frequently goes out and comes back.)

Buddha (annoyance): I hate math, friends! I have forgotten all I practiced last night!

Shikhar (carelessly): Then!

Buddha: Both of you don't but me only, why friends?.... What shall I do? (Pulls his head hard) I don't know why I was born with dull mind! Oh, god!

I (consoling): We also forget, Buddha! But we again practice it. Don't blame to your mind; rather you again practice it!

Shikhar (practical); Be practical, friend! Look, how many pages I have finished in my practice? But count your pages; it's just two/three pages. You have still one month; take my advice, just keep practicing!

I (agreement): Yes, Buddha! And if you will have some confusion, take our help.

Buddha (calms down): Ok, my teachers! I welcome your advices by heart. Thanks a lot!

(The act of practicing math goes until the SLC exams are over. Buddha could attempt the questions only of 40 marks. He is confident that he will pass the SLC. The very next day after the SLC is over we return our homes after a long monotonous and exhausting atmosphere. Shikhar himself urges us to go to watch the film "*Kusume Rumal*" as if he is signifying especially to Buddha that everything has a right time to do. We watch the film and take photographs in the photo studio.

After four months, it is Friday night; Radio announces the SLC result. The very next day I and Buddha go to the school where we meet all the friends. Some are busy in finding their symbol numbers in the newspaper called '*Gorkhpatra*'. Some are celebrating and a few are crying. My heart beat roars. Shikhar comes to me and takes me a bit further and tells that both of us pass in the highest second division while Buddha is failed.)

 (Curtain falls slowly and stage light's off

Episode 3: Experiencing a Culturally Decontextualised College Mathematics

Education

(The Director makes an announcement that Episode 3 is going to start soon, briefly

explaining to the audience about the nature of the drama that is to be performed

soon.)

Whistle blows

STORY TELLER-RESEARCHER (Background music is on)

(It could be any day of hot summer, 1991. Newly re-establishment of multiparty

system of democracy in the country has brought new hopes to all Nepalese people all

over the country. But it has not touched us- I, Rajesh and Subash, because exams are

on our head. Today we have decided to dissect Algebra by sharing ideas and

knowledge in group study. They are already in my rented room at Tintoliya Pipalbot,

Biratnagar. I am unable to understand Group Theory in Algebra. In this regards,

Rajesh is ready to teach us today. We are sitting on my bed in three sides facing to

each other. We open the book and turn the chapter "Group Theory".)

Rajesh: Shall we begin?

Subash: Of course, Rajesh.

I (different view): Who was that disgusting fellow who discovered Algebraic

theories?

Rajesh (laughs): Indra, you are humorous friend! Why to know all about these now?

It's all nonsense. Whoever they were, they were great!

I (concerns): No, friend! What'll we get after studying this?

Subash (smiles): We will get certificate if we pass and become a teacher in some

school.

Rajesh (adds): That's true! But I have been applying for the scholarship of engineering. If I am done, I will be in the practical field. There will be no tension of all these stuffs.

I (anxious): I know you will do it but what about you and me, Subash?

Subash (repeatition): Don't worry Indra, we will be teachers in some school. (Laughs)

I (serious): And we will teach Algebra there in school, yes? …..No friend, there must be some provisions for the students.

Rajesh (curious): What provisions? Can you make it clear?

Indra (confidence): Provisions of choosing subject of their own interests! Subjects should be categorized according to the field and interest of the people.

Subash: You mean, subjects should be practical and there must be choices.

I (acceptance): Of course! The curriculum must speak the needs of the people of the country. It should be contextual.

Rajesh (astonished): Like vocational subjects! Anyway, how came this idea in your mind, Indra? You should be a political leader!

Indra (confidently): You know, I am teaching part time tuition and coaching classes. I always teach them to find the answer. They listened to me carefully in a pin-drop silence mode. They do what I suggest. When the answer comes, they are happy. If not, they ask me and I help them to find the solution. We also did the same when we were students! Passive, honest listeners were we! But see, what we are studying here, Algebra!

Subash (astonished): I know that Algebra is abstract but from today, one more abstract is added in my dictionary and that is you. (Smiles)

Rajesh: But if you want to be a teacher, you can go for education faculty. (Pauses) Algebra helps in gaining the knowledge of logical thinking. Certainly, it will be helpful for us to solve the difficult theorems in school.

I (concerned): No, friend! Education only teaches how to teach so far as I know! But if we study in science faculty, some chapters like sets, coordinates, trigonometry, etc. helps us updating knowledge. I agree with you that Algebra helps us in gaining logics but isn't there other ways of learning the method of logics? So, our curriculum is absurd!

Subash (serious): I think you are talking about revolutions in curriculum. The curriculum should be upgraded or changed so that we can study the subject upon our ability and interests.

I (add more): Yes, It should be fit in our soil. Does it signify the interests of your, mine and others? We are the slaves of foreigners. We teach and learn what they have already discovered and invented in our foreign dominant so-called curriculum.

(Rajesh stretches out his both hands and body and take a long breath)

Rajesh (passionately pats on my shoulder): You will become an educationist in future, Indra. After B. Sc. better you go to the education field.

I (smile): Ah! Only such a discussion does not determine our future in Nepal. My point is that our curriculum may not produce skilled man power. Then how can I be educationist in future? Let's see, what will happen to me in future!

Subash: Wherever we'll be in future, we must be in touch anyway.

Rajesh: Of course! But I agree with you, Indra. There is no future guarantee in Nepal. That's why; I am trying to flee from this country.

I (concerns): Rajesh, best of luck to you! But once you think, what would happen to this country if all the people like you go abroad and settle there?

Rajesh: If I go abroad for my higher studies, who know if I will come back to my homeland. But first, I have to become an engineer.

Subash (interjection): Shall we conclude our philosophies now? It's already more than an hour spent in this discussion. Shall we start our foreign Algebra, as Indra said?

Rajesh: Yes, friends! Anyway, it was very fruitful. You are a critical thinker, Indra!

I (smile): Thanks! And I am sorry for engaging you in discussion. Now let's begin!

(We now concentrate in our abstract algebraic thinking! Rajesh teaches us Group Theory for about two hours and both leave my room. I get clear knowledge of solving algebraic structures and theorems from Rajesh.)

(A long blow of whistle and stage light's off)

Discussion and Chapter Summary: Speaking as a Story Teller and Researcher

Over all the three episodes portray how decontextualised mathematics is taught in school and colleges of Nepal and how practices of informal cooperative (group) learning help to understand mathematics for the students. Especially, this chapter is focused to portray the decontextualised mathematics learning in schools addressing the research question numbers 1 & 2.

The first episode lays an impression that a student without concept of mathematics cannot solve algorithmic problems which, in turn, distracts him/her from mathematics; only rote-learning does not ascertain that learners can achieve their goal laid by the objectives of the curriculum that is inclined to Habermas' technical cognitive interest. Dammar is not grasping all multiplication tables while his friends do. He has no confidence in himself that he can learn mathematics. His friends are able to do the multiplication of decimal numbers while he is not.

Dammar even cannot understand what the teacher teaches in the class because the teacher speaks too fast. As the teacher has to control the class to achieve the goal of his teaching objectives, he does what he thinks is easy. The students are talking about the important questions for the upcoming examinations. If there is no way of achieving the objectives, the teacher uses another way: for example, providing the important questions to the students so that they at least pass and no one will be there to question the teacher afterwards. The teacher is defensive here.

Dammar seems to be weak in mathematics from his early classes. How could this happen to him? Fear! There is a fear of the teacher. How is this fear created in him? Due to the controlled and managed environment being created by the teacher in the classroom to achieve the objectives of the curriculum! These are all interrelated components of teaching-learning mathematics which guide students for their learning habits. Finally, fear of teacher turns into fear of mathematics. Why students are distracted from learning mathematics? Due to lack of proper vision in curriculum! The curriculum is not culturally contextualised from the early classes. Students have to learn their cultural related mathematics in a rote-learning method – practice, practice and practice. Dammar asks 'why, how and what' and Hari replies this is not the time for 'why, how and what' rather it is time for practicing the important problems for the upcoming examinations.

In the Act II of Episode 1 it is clearly visualized the controlled and managed environment of the classroom where the teacher Mr. X uses the stick as a teaching material to impose the knowledge of mathematics to his passive students. No formal group learning in the classroom. However, the students are trying hard to understand the core of mathematics themselves in group learning at home. After giving punishment, a chaos environment is being created and the teacher asks the students to

do the problem on blackboard. No one dares go front. But one character "I" goes there upon the teacher's order. Others are just passive listeners. He then gives to do the same problem without highlighting how it is done. He is not accessible to all students in the classroom. How can all students solve the problems?

Poor Dammar is scattered from the punishment and he blames that his father is not good in mathematics and so is he. This really leads a student to school drop-out. His diversion from mathematics is not only due to this event of punishment rather it is old wound which is induced now. Despite of pouring advices and counseling, Dammar with heavy heart and mind joins the group learning at his home. He is now completely frustrated and hence he is sleeping before their friends come to his room in the Act II of the third episode 1. He has not understood anything in the class as if he wants to be free from this culturally decontextualised mathematics.

The Act III of the episode 1 portrays that how one student who is distracted from culturally decontextualised mathematics paves his path towards learning mathematics with the help of his friends. He is about to quit learning mathematics and his teacher Mr. X doesn't know anything what is going on with his own student. Even the nature has not supported him when he is in pain, it's gloomy, going to rain and it rained! Frustrations everywhere! But there come two friends (I and Hari) like angels of god and they help him come back to the right track. Moreover, it is very hard for students (even teachers?) to link algebra with their cultures. The variables x, y, z…a^2, b^2, c^2 do not mimic their own culture or teachers are not able to teach it linking with culture! That is what the question here! That is what the curriculum does not speak about! And the teacher has no way to link it with anything rather they make students understand mathematics by any methods (e. g. rote-learning, practice, etc.) in the

controlled and managed environment. There is no any fruitful interaction between the student and teacher and amongst students (Habermas' practical interest).

Episode 2 portrays how pair-work (pair-learning) helps a student (Character I) to achieve the concept of proving geometric theorem. It is the duty of teacher (and curriculum) that every student must understand what it is taught. The culturally decontextualised mathematics curriculum in Nepal has made most of the students helpless. The character Shikhar is behaving as a quasi-teacher and is doing the job of the teacher (Act I). Every student cannot be like Shikhar. Then, whose responsibility is this to make students like 'I'? It is easier to escape from this problem for every responsible person is leaving all responsibility to students but it would be fruitful if some of them take the initiatives of finding the real problem and solution as well. This Act II also depicts that pair-learning helps students learn easily as there is no any hesitation /fear of teacher. Hence cooperative learning certainly helps students learn mathematics easily. This Act II has also given a glimpse of how mathematics is linked with our culture when Shikhar explains the Pythagoras theorem to his friends in the classroom. Only 'god' knows if other students were doing so as both Shikhar and 'I' was doing. Shikhar is lucky to have his brother an engineer while his friends Indra and Buddha are not so. However, both of them try to get the cultural link of mathematics.

Here I wish to go back to history of mathematics. Historically, mathematics is linked with culture. Mathematical ideas and concepts were developed simultaneously across the world. Different cultures had different features of mathematics and treated mathematics differently. The foundations of mathematics may have emerged from the need to trade in ancient time. For example, a traditional "apple-to-pig" exchange would consist of a variable number of apples for one pig (Hammond, 2000, p. 16).

The usefulness of mathematics is what tends to conceal and disguise the cultural aspect of mathematics. Hence, I claim that mathematics was developed simultaneously by different cultures across the world. Babylonians invented a place value number system, different methods of solving quadratic equations and the relationship between the sides of a right-angled triangle, which later came to be known as "Pythagorean theorem (Joseph, 1997 as cited in Hammond, 2000, p. 18). Egyptians pursued geometry to aid in the creation of complicated architectural structures. Egyptian fractions and accuracy of 'pi' were developed for the development of such structures. India developed the number system and pursued more theoretical aspects of mathematics. Greeks have been credited with the development of more sophisticated form of mathematics that serves as the basis of what we use today. Hence we can examine how mathematics were linked with cultures and how mathematics differs from culture to culture (Hammond, 2000).Such a cultural flavoured mathematics is being taught in Nepal as a pure/and rigid mathematics without contextualizing it.

I have insisted here to lay down the glimpse of history of mathematics because this certainly opens the eyes of those who are unaware of link between mathematics and culture. My intention is not to urge that pure mathematics is to be excluded rather mathematics teacher at least can link it to our culture and also design some related project. This will certainly lays some positive impression that mathematics is not only brought from *foreign* (Luitel, 2009) countries, it is also practice in our society (I will portray this in the next chapter).

The Act II of this Episode 2 portrays how mathematics has divided class IX students into two types: optional math and compulsory math. In Nepali school there are two mathematics in practice from class nine to ten: one-compulsory mathematics

which all the students have to study while other- optional mathematics which is open only for eligible (so called brilliant) students. From one side, it seems to be sound for the students that they have a choice but from other view it is seen that there is some negative impression laid to the students that only able intelligent students can take optional mathematics. It means other students are weak in mathematics. To depict this view-point I have displayed this Act II in the Episode 2.

The character 'I' has less confidence, Buddha has no confidence and Shikhar is confident in choosing optional mathematics in the beginning. However, all prepare for it and take the first class: two of them understand what the teacher has taught about trigonometry but Buddha does not. Shikhar is a smart boy as his engineer brother usually guides him at home. The teacher just lays the definitions and formulae with some calculations which he clearly explains in the class but does not explain how it is linked to the culture of human society. But Shikhar gives a clear proof of Pythagorean formula linking it with culture. It is clear example how culturally decontextualised mathematics can be contextualised in the classroom. It may not be possible to link each and every topic of mathematics to the culture but a teacher should be very careful in case of laying impression of mathematics on students in such a first chaotic class of optional mathematics. Buddha drops out optional math. I would say because the teacher could not convince him satisfactorily.

The Act III of the Episode 2 portrays the scenario of how SLC candidates prepare for the upcoming examinations. In this scenario, dropped-out student Buddha is accompanied by his two friends Indra and Shikahr. He has been already out of track. He is already in the run of other part of his life-enjoying smoking, playing girls and hence not interested in getting better marks in the SLC examinations rather he wants to get just pass marks for the *sake of his father*. How could it happen? Some

students drop out due to fear of teacher and some due to fear of mathematics (There may be other social reasons behind it, however fears of teacher and mathematics are also the root cause for it). Students are prepared for exams to get pass or better marks as animals are trained for circus. As I mentioned above that curriculum has made teachers defensive, they think that their objectives will be fulfilled if the students are able to pass or get better marks in the examinations.

Episode 3 gives a lived example of the adverse effect of learning culturally decontextualised mathematics in schools leading the character Indra to the same problems in college level. Culturally decontextualised (pure) mathematics has helped Indra to pass the school examinations and allows to get enrolled into science faculty in college. Though he was enjoying mathematics more or less in schools, he is gradually distracting himself from it in the college level or he is now strong enough to distinguish the education system of Nepal from that of western countries. His problem in Algebra made him think about the curriculum system of Nepal. He wants reform in curriculum of Nepal; it should emerge with the peoples interest embedded to their cultures; there must be provisions for students to choose a particular subject right after SLC and the curriculum should be reformed accordingly. Here he stresses for a particular subject; for example, if a student wants to study mathematics only, he should be allowed to go for it only without other subsidiary subjects as it is in Nepali curriculum. In schooling he never takes initiatives to contextualise his academic mathematics from his side rather he enjoyed it. Now in college life he has seen the outer world and read some books which made him think about reform of education. Moreover, it happened in his life when he himself became informal teachers teaching the students in tuition and coaching classes. He was questioned by his students 'why, how and what' which his friend Dammar (Episode 1) used to ask him in school life.

On the other hand his friend Rajesh (Episode 3) is about to flee from the country for his engineering course in abroad. Most of the students settle in abroad and do not come back to Nepal after their higher studies. Indra does not digest this train of Nepalese students so far.

Above all, my mind is usually distracted by this education system of Nepal. Here I draw a conclusion that the academic mathematics of Nepali schools and colleges are more leaned towards *upgrading* students rather than *updating* knowledge to students. Students are taught in a closed monotonous environment for many years as animals are trained for circus for many days. The trained animals do the same as their boss have taught and so are the Nepali students following their teachers. If parents are well-educated, their children may carve their path accordingly. But other people can do nothing if teachers are not there to create conducive environment in the classroom. Teachers are guided by the curriculum and Nepali curriculum is documented to flourish pre-determined knowledge. I have read some books wherein I have found that the curriculums of western countries are based upon children's interests/cultures. But our curriculum does not match our soil. There is no flavor of our society and cultures. Foreigners discover or invent new things; we comprise them in our curriculum. Some questions always come and go in my mind, "Why do we follow foreigners' footsteps blindly? Do they do the same as we do or they collect knowledge from all over the world and mould them into their own type? Can't we mould foreign knowledge into our type?"

Above all, in this chapter II, I have attempted to depict what it is going on with me as a victim of culturally decontextualised mathematics education from early education to college level before I joined Kathmandu University. It was very difficult for me to point out the root-cause of why students usually fear of learning

mathematics! I knew that I was honest to teach students mathematics by giving good concept (most probably algorithmic concept) of learning mathematics. I knew that some scored very good marks and some moderate while some failed. But I have found that even better students also do not have interest of continuing mathematics learning after SLC; when asked the reason, they usually replied that it is hard, time consumable and absurd. It made me think to find out the root-cause and I poured some into this chapter.

When I joined KU, I got knowledge of educational philosophies and their practical implications in teaching-learning practices. Then I started applying them into my teaching practices as a professional teacher. It was very hard for me to transform as a constructivist teacher with critical thinking; it was so painful for me. The students were passive recipients; there was a controlled environment in the classroom and I was a conventional teacher. How hard it was for me to transform all these! What should have gone through my mind at that particular span of time! No one could understand my feeling. However, I gradually caught the right rhythm and rhyming and keep my pace of teaching and learning mathematics in a new method of teaching. I was determined; I was on my new voyage of implementing mathematics teaching in the classroom. For this, I had to fight against two rivals: one, my conventional teaching mind-set and other, the students and surroundings. I was in quandary how should I implement what I have learnt about mathematics teaching from KU? But the Principal and Management of the school supported me to implement either and I gradually catch the pace.

While writing this chapter, I was so excited that there used to be goose-bumps all over my body every single moment. It was a golden opportunity for me to pour all my knowledge (feeling, emotions and experiences) that is created due to culturally

decontextualised mathematics education. And I did not sleep overnight for several days while writing this chapter and worked for several days without caring my health (Blood Pressure raised, dehydration in my body, back-pain and anxiety). I managed it as I had in my mind that I was doing a research inquiry on the hidden problems (probably the root-cause) of mathematics education system of Nepal leading students to distraction from learning mathematics. As a novice researcher, it was my great opportunity to pave my path towards research field; therefore I could not leave any work undone. Dr. Luitel's regular supervision also encouraged me do my research inquiry very carefully and insightfully.

What did I learn from after writing this chapter? This was a relevant question in my mind. As a novice researcher, I learnt how to present the purposed theme in an artistic way keeping a view-point that the art-based research inquiry should give morals and messages to me and the readers of this inquiry. I have presented this chapter from a critical thinker's view-point opposing and challenging the culturally decontextualised mathematics education system (curriculum) of Nepal. It was very hard to do so because I am a novice researcher and above me there are many educationists in Nepal who are responsible for running the education system of Nepal. But I thought that it could be like "a drop in the ocean" for those who act as if they do not know the root-cause of adverse effect of culturally decontextualised mathematics education in Nepal and that "drop in the ocean" could compel them at least to think/rethink about the "contextualisation of mathematics education".

Finally, I want to present a piece of text which may reflect how culturally decontextualised mathematics education and its actor (teacher) compel a student to drop out from the school and that practical knowledge (culturally contextualised) transforms his life.

"……Imprisoned every day in the one-room classroom, he felt utterly lost…… Al was frightened of the cane , but he still couldn't learn the great lists of facts the teacher told him to. His habit of asking questions just made the teacher even more angry….Then he heard the schoolmaster talking about him; there was something wrong with young Edison, the man said. He was "addled"….In a rage he rushed out of the schoolroom and refused to go back (Sproule, 1995, p.12-13)." This is the story of one of the great inventors of all time, Thomas Alva Adison who harnessed electricity for domestic use. I agree with Sproule (1995) that one way traffic teaching method does not create knowledge rather it suppresses most often the children's creativity. The curriculum is also responsible for this to create a chaos and monotonous environment in the classroom. Sproule (1995, p. 13-14) further writes, "At home, his mother, Nancy, took his side in battle……One day when he was nine, she gave him his first book on science. Called the "*School of Natural Philosophy*", it gave readers simple experiments they could carry out at home. From that time Al's life was transformed…."

CHAPTER III

CONTEXTUALISED MATHEMATICS EDUCATION: A BASIS FOR

DEVELOPING CULTURAL AND MATHEMATICAL CAPITAL

My Early Mathematics: A Tenderfoot

One for little finger, two for ring

Three for middle and four for index

Five for thumb, one-to-one correspondence

The flock of birds flying on the sky: patterns

Pebbles, marbles and clay-balls: polyhedra and spheres

The catapult pointing at birds: Angles

Ah! Complete Natural Geometrical symbols!

To fill a mug to the brim: Limit

 A ring round the moon is pi times d

Right over left palm: Symmetrical

Mats of straw: Square and rectangle

In the world of abstract and transcendental,

It was my early Mathematics: A Tenderfoot!

At the horizon when I used to look!

Chapter Overview

This chapter revolves round the 'contextualization of culturally decontextualised mathematics through inclusiveness, cooperative learning and ethnomathematics' henceforth transforming myself from technical to practical and emancipatory teaching and learning of mathematics so as to make it more meaningful to students' lifeworlds and portrays my journey of teaching and learning to contextualise mathematics (Luitel, 2009) by emphasizing the role of students and contexts in the mathematics classroom especially evoking the research questions 2, 3 and 4.

The chapter is fractioned into three episodes of stage show: the episode 1 is fractioned into Act I and Act II in which I have laid down the situation of teaching as an educator to the school teachers about 'teaching mathematics in the contexts and cultures through a parallel discussion of ethnomathematics'. The whole Act 1 is encircled with contextualization of mathematics teaching in the classroom situation and that of Act 2 is centralized to link academic mathematics to ethnomathematics. The episode 2 is all about teaching school mathematics to class VII students in the contexts of various cultures of our society through a wide interaction. The episode 3 depicts how mathematics is contextualized through cooperative learning evoking the Habermas' technical and emancipator interests in the classroom situation. Over all, all the three episodes are central to speak out 'contextualisation of culturally decontextualised mathematics' in the process of teaching and learning mathematics as a teacher and an educator.

My teaching and learning inspired me to critically think one step ahead in teaching and learning of mathematics than what I had been practicing before joining at Kathmandu University. In my journey of teaching and learning I found that mathematics is a mysterious subject and a number of myths are associated with it.

These myths include commonly expressed views such as "mathematics is just a computation", "mathematics is just for clever people (and males), "your father is a math teacher so you must be good at it too" (Sam & Ernest, 1999). I usually encounter with students having such myths in my everyday teaching practices and so I got to think critically about what is mathematics. My study helped me to learn many more facts about this mysterious subject. I started viewing mathematics from the eyes of *absolutist* and *fallibilist*. Absolutists claim that mathematics is perceived as a set of absolute truths meaning that mathematics is a subject of which always has write and wrong answers, and there isn't anything in between. Opposing this view, fallibilists claim that mathematics is not rigid rather it is an incomplete and everlasting work-in-progress (Ernest, 1996, p. 1).

Moreover, their views widen my thinking about mathematics and I fractioned my views diversely. Can I see mathematics from *utilitarian view* which speaks that mathematics is viewed as a human tool to calculate and predict in everyday life; *symbolic view* which asserts that mathematics is perceived as a collection of numbers and symbols; *problem solving view* which states that mathematics is related to a set of problems to be solve; *enigmatic view* which stresses that mathematics is seen as mysterious but yet something to be explored and whose beauty is to be appreciated meaning it is seen as mysterious, foreign and incomprehensible and yet it is also 'like a sunset-unique and beautiful? On the other hand, can I see mathematics as a *metaphorically*: mathematics as a journey, mathematics as a skill, mathematics as a daily life experience, mathematics as a game or puzzle (Sam & Ernest, 1999)?

Above all, in me mathematical awareness appears to develop differently in different situations. Incorporating these views and beliefs about mathematics in my mind-web, I challenge to myself to take some risk of teaching and educating people

about 'contextualisation of our Nepali culturally decontextualised academic mathematics' after my admittance at Kathmandu University.

Boaler (1993) states that "students are able to demonstrate their knowledge and understanding of mathematics in situations outside the classroom when three contributory processes have taken place. Firstly, the student needs to recognize that the requirements of the task are represented in previous learning, secondly this information needs to be retrieved, and thirdly the student needs to translate this information to fit the demands of the situation (p. 13-15)" I then concluded that mathematics can be learned in school, embedded within any particular learning structures, and then lifted out of the school to be applied any situation in the real world. It suggest me that when context is recognized as a powerful factor influencing learning of mathematics, then mathematics in an "everyday" context is easier than its abstractness and learning mathematics in an everyday context can ensure transfer to the everyday lives of students. Moreover, the abstractness of mathematics has become synonymous for many students with a bold, detached, remote body of knowledge. Here I relate it with Luitel (2009) saying that Nepali school mathematics is like a pure body of knowledge which must be broken down by the use of contexts which are more subjective. Using real world, local community, and even individualized examples which students may analyse and interpret, is thought to present mathematics as a means with which to understand reality. This allows students to become involved with mathematics and to break down their perceptions of remote body of knowledge (Boaler, 1993). Then certainly such perspective, which includes an awareness of the utility of mathematics and its involvement in the real world, motivates and engages students.

In this chapter I have tried to link mathematics to the real lifeworlds contexts and the contexts are also presented as general motivators, offering students exciting and real life examples that engage their interest. In the episode 2, I have created a situation "Excursion on contextualization of mathematics" and students will explore mathematics in the real world. Similarly in the episode 3 academic mathematics of class IX is linked to the real world. For example, *function* is related to "firing a pistol" and "rice mill". My aim is to consider mathematics which is commonly used in "real life" situations and which may usefully be brought into mathematics classroom for discussion and exploration. Orey and Rosa (2004) state that D'Ambrosio distinguishes between academic mathematics and "ethnomathematics", using the prefix "ethno" broadly to cover the mathematics used by all culturally identifiable groups and individuals with their "jargons, codes, symbols, myths, and even specific ways of reasoning and inferring". By contrast, academic mathematics is the mathematics which is learned in institutions like schools and colleges. I assert that if students discuss their own "ethnomathematics' in the classroom then the distance between students' perceptions of "school (decontextualised) mathematics" and "contextualised mathematics" will be reduced. Moreover, mathematics classroom is itself a place of values with its own cultural perspectives and the cultural solutions to problems offered by students in the real world are also mathematical. Thus, mathematics is a part of students' social and cultural lives, and the mathematics classroom has its own social and cultural life. That's why; I have included a situation in Act II of episode 1 to portray a wide interaction about the possibility of inclusion of ethnomathematics in Nepali curriculum.

If the students' social and cultural values are encouraged and supported in the mathematics classroom through the use of contexts, then their learning will have more

meaning for them. Their social, cultural, personal or "ethno" mathematics will be given enhanced mathematical recognition in a social setting, and this in turn will enable connections to be made with the mathematics of the classroom which may make this more meaningful when students are faced with the denmands of the "real world" (Boaler, 1993).

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Episode 1: Experiencing the Culturally Contextualised School Mathematics Education I

Act I

(The Director makes an announcement that Act I of Episode 1 is going to start soon, briefly explaining to the audience about the nature of the drama that is to be performed soon.)

Whistle blows

STORY TELLER-RESEARCHER (Background music is on)

It could be any Sunday of May, 2009. I was along with the teachers (Class IV, V and VI) in a classroom. There were altogether 12 teachers in front of me. I was going to conduct a math workshop on the topic "*How to teach Algebra in preliminary stage*?" in the first session. It was a mid-day just after lunch. The fan was on displacing hot air inside and I could see the teachers anxiously waiting for my training. I asked them to settle down. After that they were divided into three groups A, B and C. I gave three different questions for three groups as follows:

Group A: Ram has 5 apples in his hand. He gave 2 apples to his friend. How many apples are left with Ram?

Group B: Sita has Rs. 5 with her. Her mother gave her Rs. 2. How much money does Sita have altogether?

Group C: Melina collect 5 pebbles and gave it to her father. Her father has already some pebbles with him. If her father has 8 pebbles altogether, how many pebbles did her father has before?

I asked them to find the answer in two ways: arithmetically and algebraically. At first I highlighted all the questions and asked them how to teach these questions. Their mixed types of answers compelled me to explain how these questions are dealt with while teaching. I then asked them to have a group discussion and prepare the presentation in chart papers using concrete materials (I had already collected apples, pebbles and moneys). They started their group discussion. I gave them 30 minutes for discussion and 5 minutes for each group for their presentations. I then wandered around to see their works by encouraging them. Finally the time of their presentations! I stayed at the back and noted the points and asked other groups to do the same. The presentation was over. I started my comments on their works which are summarized as follows:

"You all did your job great! I appreciate your confidence of presenting your matters with the help of materials. If you apply this to your children in your class room, it will be an interactive class and I am sure every student will understand the preliminary concept of Algebra clearly. Make sure that each and every student is actively participating in group discussion. You have to emphasize why the letters are used in Algebra. What is all about Algebra? In addition, do not forget to tell them that we can find mathematics in and around us, at school, at home, at market, everywhere in our everyday life. Only lecture method and writing on the board are not sufficient to build the conceptual framework on pupils' mind; it should be visualized."

(I took a long breath and some water)

"I emphasized here the '*visualisation of mathematics*'. Once you just go back to your past life and recall, which events do you remember most and quickly?"

(One of the teachers immediately told that the event in which some incident happened. I then asked him to explain it. He told that he never forget learning the fractions by using 'apples'. He said, "The math teacher had taught us fractions by cutting the real apples and afterwards he had given us these pieces of apples to eat." I intercepted him.)

"This is what all about learning mathematics. You all also do the same first and then enter into the lesson for problem solving. Only algorithms and problem solving do not give the real falvour of mathematics. It may lead the students to diversion from learning mathematics. Moreover, you can use the concrete objects which are found in our homes, society and cultures."

(Immediately, one lady teacher asked how we can find mathematics in our cultures. I then first clarified the concept of culture in brief and then asked them to find mathematics from the cultures)

"Culture refers to a set of values, norms and beliefs that are common to a group of people who belong to the same ethnicity. It also refers to the customs of a particular people. Now you find mathematics being practiced in our cultures of society. A teacher should be able to convince his/her pupils that all mathematics they are studying is originated and developed from the cultures all over the world. One simple example can be given: we use *dharni* to weigh potatoes; our previous generations (grand-grandfathers) used *mana, pathi* to weigh rice, maize, pulses, etc. and they used rice, maize, flour, etc. for the wages of

labours. We are still using *nanglo, doko, gundri, piraa*[6]*, halo*[7]*, kuto, kodalo,* etc. in village farming in which we can find geometrical shapes such as circle, rectangle, square, polygons, cylinder, frustum, etc."

(Other lady teacher raised her hand with a beautiful smiling face and asked one interesting questions. She said, "May I ask my students to collect mathematical shapes from their homes, sir?")

gundri

doko

kuto

 "That's it, madam! Before you start your lesson, ask your students to collect the geometrical objects which are used in their daily life at home to make them familiar with real objects rather than their photographs and then only start teaching geometrical shapes. Look! You have *contextualized* your academic mathematics with your cultures now. If you encourage the students to collect the objects that are found in their own cultures, it will lay an impression that their cultures are valued. In this diverse culture of our society, we can teach them mathematics interestingly. Students from diverse cultures may bring diverse materials for you in teaching mathematics. Have you ever noticed the *dome* we can see in Buddha temple? It is hemispherical. And the pyramids of Egypt in Discovery channel! In fact, contextualization of mathematics not only increases the interests in learning mathematics; it also enhances their imaginative power so far. And you must have heard Einstein saying "Imagination is more important than knowledge."

(I again take some water from the jug and continue).

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[6] A mat of straws
[7] An object (like spade) used for ploughing land and it is pulled by a pair of bullocks

"How are you feeling, teachers? Boring or…!"

(Loud voice roared: "No sir! It's interesting." Instantly, one of them spoke in a loud voice, "Sir, truly speaking, I am getting the real flavor of mathematics today." I then paused here as I had to conclude their presentation. I drew the conclusions in the following way)

Answer to Group A question:

Arithmetically

Ram has	He gave	left with Ram
5 apples	2 apples	? apples
5 apples	2 apples	3 apples
5 − 2 = 3		

Algebraically

Ram has	He gave	left with Ram
5 apples	2 apples	? apples
5 apples	2 apples	x apples
5 − 2 = x		

Answer to Group B question:

Arithmetically

Sita has	mother gave	Sita has
Rs. 5	Rs. 2	Rs. ?
Rs. 5	Rs. 2	Rs. 7
5 + 2 = 7		

Algebraically

Sita has	mother gave	Sita has
Rs. 5	Rs. 2	Rs. ?
Rs. 5	Rs. 2	Rs. x
5 + 2 = x		

Answer to Group C question:

Arithmetically

Melina collect	father has	father altogether
5 pebbles	? pebbles	8 pebbles
8 − 5 = 3		

Algebraically

Melina collect	father has	father altogether
5 pebbles	x pebbles	8 pebbles
5 + x = 8		

(After conclusion we took some snacks and tea. It was already an hour or more. During our tea session, the teachers were having great interaction about today's workshop. And one teacher came to me and asked how to give the preliminary concept of 'constants and variables' in Algebra to the students. I got the topic and drew their attention that after five minutes break I would be giving them the concept

of constants and variables if they were ready. They agreed. Finally, I began my

interaction with them about the topic.)

"My friend, Mr. Jha has just requested me to have an interaction about the constants

and variables in Algebra. Therefore, before we conclude today's workshop, we are

going to have a discussion on the topic, "How to teach the concept of *constants* and

variables in Algebra!" Do you have any idea about the meaning of these terms?"

(They whispered each other for a while and one male teacher raised his hand and said,

"The constant has its value always the same and the variable has its value

changeable.")

"That's good! Now tell me how do you connect it with our daily life situation? Or you

just tell your pupils the definitions and start your lesson?"

(I paused expecting reply from their side. Some discussion among them! A while

later, one of them spoke, 'Sir, will you explain from your side, please? I think no one

of us has its solution!" I then continued).

"Ok, I will give you one idea. You need to go first straight to the busy highway and

stand aside. Then count the number of vehicles that pass by you every hour and note

them. Spend some hours and come back home. Now see your recorded data. Are they

same or different? If they are same, it is a constant; if they are different, it is a

variable!

("Wow! Sir, you're great!" said one lady teacher. Another male teacher said, "Then

we can also tell students that number of days in a week is a constant and number of

days in a month is a variable, sir?")

"Here came out another example. (I was excited) This is how we can give the

conceptual meaning of mathematics! This is how we can contextualize mathematics!

One thing more, my friends, you can design some project works on "contextualization

of algebra, arithmetic, geometry" and give to your pupils. Make sure that your project works should be more likely to link mathematics with the pupils' cultures. (Pause for a moment) For example, I will tell you one. Design a project work such as "Collect the geometrical shapes found in your home, community or society related to your culture, list them, write their uses, paste their photographs or bring them to the school if possible" (Rest my back on the board) Now form some groups of students from same locality so that they are accessible to each other in collecting information and give them this project work. Better give sufficient time span, maybe two weeks or whatever you feel appropriate. In between, you keep your interaction with students how they are doing."

(I now moved here and there, back and front while expressing my view-points)

"When they submit their project works, do a seminar so that each group can present their project works in front of all. Reward some of the best ones in presence of the Principal or Coordinator of the school, because every human being is hungry of admires; students wish their hard work be valued. After their presentation, you should give your conclusion highlighting the facts that mathematics is in and around us, in our home, in our, community, society and cultures."

(I looked into their eyes: they are focused and writing some notes)

"Now when you start your lesson in the class; link your teaching with their project works time and again. This would be the better teaching-learning process in the classroom. You all, being teachers never forget to teach mathematics in the context of cultures. What do you think?"

(The first session of the workshop finished. 10 minutes break! Teachers went out.)

(Background Music On: Curtain falls slowly)

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Act II

(The Director makes an announcement that Act II of Episode 1 is going to start soon, briefly explaining to the audience about the nature of the drama that is to be performed soon.)

Whistle Blows

STORY TELLER-RESEARCHER

(I was waiting for the teachers to come back. I was arranging the papers for them. Here it was time and all the teachers came in one by one and took the papers from me and took their seats. In this second session I was going to conduct the workshop on "*Contextualisation of Mathematics: An ethnomathematics Perspective*". My objective today was only to introduce the term to all the teachers. When I wrote the topic on the whiteboard, everyone was surprised. There was some weird-feeling in all. Most probably due to the new word "ethnomathematics" with which they never encountered before. Before I began my workshop, I read their face for a moment and gave a lovely smile to them. I also could observe that they were eagerly waiting to know the meaning of ethnomathematics. I wanted to explore the possibility of inclusion of ethnomathematics in Nepali curriculum. For that, I wanted to collect the views of my school teachers. That's why; I designed this short workshop on this topic and here I was with the teachers.)

I (stretching my chest with passion): "A warm welcome again! Today we are going to deal with this new stuff 'ethnomathematics'. Hope you will cooperate."

(As soon as I pronounced the word 'ethnomathematics', they roared in one voice)

Whole teachers (curious): "What is this ethnomathematics, sir?"

I (clarifying): "Ethnomathematics refers to the study of mathematics in relation to culture. Its credit goes to a Brazilian educator called Ubiratan D'Ambrosio. I have given to you the papers in which information about ethnomathematics is given. Today I just wanted to introduce it to you and expect some views about its possibility of inclusion in Nepali curriculum though it is completely new in Nepal"

Mr. Jha (curiously): "It means the mathematics practiced in different cultures?"

I (exciting): "Very good, sir. That is what we also discuss in the last session. It is very complex to understand but for now we just think that it is a mathematics practiced or being practiced by different groups of people such as carpenters, potters, farmers, vendors, etc. in their culture of daily life. Today we are going to have an open discussion about this type of mathematics. Whatever we know and have experiences, we share here and try to explore its possibility of inclusion in our Nepali curriculum."

Mrs. Shrestha (humorous): "Oh! Sir. How could you come up with this idea in this 21st century? It is very hard to find ethnomathematics. I think we need to have a visit on the spot."

I (smiling): "Yes, madam. We need to do a deep research on it going through person to person from place to place to study their cultures and find what type of mathematics they are practicing. You can collect the information from your *Newari* community; Jha sir, you can collect from your *Maithily* community, madam Sudha from your *Kirat* community and so on. I think you all are getting my point!"

Mr. Santosh (smiles): "What information shall I collect sir from my community?"

(Mr. Santosh is from backward community called *Biswokarma (ironsmith).* In this community they practice the metal works such as making different home appliances e. g. pots, knives, etc.)

I (concern): Mr. Santosh, there are many mathematics

practiced in your community. People make metal

pots of different shapes such as knives."

Mr. Santosh: "Oh! I got it."

karai

I (calm but energetic): "Madam Shrestha, you can inquire

with you grandfathers how they practice counting numbers. I

know that our grand-grandparents used to exchange their

different things for food stuffs before the tradition of money

kuto

was introduced. For example, they exchange their cattle for food stuff. These were the

history of mathematics."

Mr. Mohan (excitedly): "I think ethnomathematics is all about contextualisation of

mathematics in relation to cultures of our diverse society."

I (acceptance): "Why not! You are right, Mohan sir. Here today I just wanted to let

you know about this new term but my purpose towards you is to make you aware of

our cultural mathematics. That's why; I suggested you to link our academic

mathematics to the culture of our society and encourage students towards it by

designing project works! (Long breath) My intention is to pave a path towards

cultural mathematics which we call now ethnomathematics. No matter how successful

we will be but it will be a valuable support for us to recognize our culture through

mathematics."

Mr. Jha (long breath): It is vast sir! I think it needs maximum exercise before it is

included in the curriculum of our present academic mathematics. Our nation is

culturally diverse and the political situation is also unstable. Whose practice should be

included in the curriculum is a problematic for us. I mean if we include the practices

of mathematics from the cultures of a particular community; others may raise their

voice against it sir!"

I (serious and sincere): "Here comes the idea from Mr. Jha. That's why; I have brought it for an open discussion in front of you. Whatever you said is genuine; it is an issue. If we raise it as an issue all over the country, there are many educationists in Nepal to resolve. For now, we just seek for its possibility in our accessible cultures only. Am I right, sir?"

(Mr. Jha nodded his head. Other teachers were in dilemma. They just remained quiet. Mr. Jha again came up with more ideas)

Mr. Jha (excited): "I think first we need to study what it is exactly and then only we can decide what to collect as information."

I (agree): "I agree with you Mr. Jha! I am also the beginner. I have got its idea from Kathmandu University where I am doing my Master in mathematics education. There I learnt that due to decontextualised mathematics our pupils are not able to get proper knowledge of mathematics and hence some of them are distracting from mathematics. It can be one means not the reason.

Mrs. Shrestha (interruption): Ok, then sir. As Jha sir said, we first study it and decide about it. But its overall impression is that it is related to our culture and we teach our students the academic mathematics in the context of their cultures. Certainly, it will be helpful for the study of ethnomathematics."

I (agreement): "This is true, madam! You just keep teaching as we discussed in the first session so that students will be aware of valuing their cultures. They are the future; they can do something about ethnomathematics in future. But it is our duty to pave their paths for future."

(All the teachers were listening to the conversations between me and a few teachers. They whispered and nodded their heads, changed their facial expressions and kept quiet. I noticed that it was fair enough for today. Before they think that

ethnomathematics is a boring subject, I immediately made up my mind to conclude

the workshop)

I (continue): "Ok, this much for today! Concluding, I say that we learn how to

contextualize our academic decontextualised mathematics and learn some idea about

the new term 'ethnomathematics'. I hope you will all apply it in your classroom

before you jumped into algorithm and calculation of mathematical problem solving.

Also hope that you will keep inquiring about ethnomathematics directly/indirectly.

Thank you very much for your patience!"

(I concluded the workshop and we departed.)

(Whistle blows and stage light is off)

Episode 2: Experiencing the Culturally Contextualised School Mathematics Education II

Whistle Blows

STORY TELLER-RESEARCHER (Background music is on)

It could be any cold winter day in December, 2009 right after the second terminal

examinations of the school. A week ago, I had prepared a proposal for an excursion

for the class eight students with the help of other mathematics teachers of the school

and put it on the Principal's desk. In the very next day, the Principal called me and

allowed to take the students for excursion to various places of Kathmandu. The date

was fixed for tomorrow. We had already fixed the places like religious places, towers,

buildings, bridges and gardens. Today I arranged an orientation class for tomorrow's

excursion. I have collected all the students in a classroom to explain the objectives of

the excursion. There were 40 students and we were five teachers altogether to lead the excursion. We first divided them into four groups A, B, C and D and chose the group leaders. I then began to explain the objectives of the excursion.

"Maintain your silence, dear students! This is the most important but new type of excursion for you all. I think this type of excursion is never conducted before in our school or most probably in other schools too. Tomorrow we are going to visit various places as mentioned in the papers in your hand. Do not forget to bring your instruments such as camera, pen, pencils, papers, foodstuffs and water bottles tomorrow. If you need any medication or help during the excursion, immediately inform your group leader and the group leader will inform the teacher leading your group. In case of emergency whoever notices the incident first, immediately report to any of the available teachers nearby you. You are asked to remain disciplined throughout the excursion and focused to achieve your objectives. We will leave the school at 10 a. m. and spend four/five hours in the excursion and come back to the school by 4 p. m. The school bus will drop you all to your homes then.

As you have been told that our topic of the excursion is "Contextualization of Mathematics" and its objective is: "To collect the information related to mathematics (arithmetic, algebra and geometry) from various places in the form of texts and visuals (still and movie) and explore how academic mathematics can be contextualized." Did you go through the paper in your hand, class?

(All the students shouted in one voice: "Yes sir!" I then continued to highlight the objective.)

Very good! Today we are going to have an open discussion about our excursion. We are going to interact to each other. Hope each and every one actively participates in

the interaction. Everyone has right to ask questions during our interaction. Are you ready, class?

(Whole class roars: "Yes, sir!" And I continued explaining)

Let me highlight the objective first. I frequently tell you in my classes about contextualization of mathematics. Today's objective is centralized to it. Contextualization of mathematics means, in general, teaching and learning mathematics in the contexts, that is, relating it with our contexts. More clearly, mathematics existing in and around us; in our schools, homes, different places, cultures, communities, etc.! In fact, mathematics we are learning is more rigid: we learn theories, axioms, theorems, corollary, formulae, calculations, algorithms in the context of foreign countries and think that mathematics is a foreign subject. Our purpose has become to get very good marks in the examinations so that you can achieve your parents' goal of your admission in science faculty to become an engineer, doctor, pilot, etc. But it is not fair in mathematics learning. Mathematics is beyond it, to gain its knowledge and concept contextually.

(One student Megha raised her hand to ask a question: "Sir, I don't want to become a doctor or an engineer, rather I will become a social worker. No headache from this mathematics!" I acknowledged her question and continued. The whole class was calm and quiet)

Why do you think that you want to become a social worker? Is it your own choice or your parents laid some impression on you? Or is there any other reason behind it?

(Megha said, "Actually sir, umm… I have no any interest in learning mathematics. It is like a headache for me. I study it just to maintain pass marks as you know it from my previous results. Viewing my anxiety in mathematics, my parents have decided my future as a social worker!" I was stunned! How easily she said that her future is

fixed by her parents' from now in the name of her anxiety in mathematics! I continued)

I understand your difficulty in learning mathematics but no one can guarantee that you will become a social worker. Who knows what happens tomorrow? Maybe, if I will see you as an engineer after some years, it will not be surprising for me, Megha! (I was humorous and the whole class gave a cackle. Other teachers also accompanied them and Megha too! The class slowly calmed down and I continued)

Ok, Megha! I hope that you will change your mind after you come back from this excursion tomorrow. This excursion will certainly help you how research is conducted.

It also helps you learn to collect information and explore them as social workers do. (Again, the class is at laugh. I intercepted them)

Please, hold on class! I mean it. It really helps you learn how research is conducted. You will learn to collect information from the crowd of people. You will learn to explore mathematics found in and around us. (Pause)…. Ok, everybody! Tell me how are you feeling? Excited?

(Whole class roared: "Yes sir, we are excited for this excursion" I became happy to see that all of them were happy. I continued)

Now I want to again highlight how our research will be conducted. To collect information, you need to go to various places to find the models of mathematical objects and take their photographs or movies, write their names and information. For example, when we go to the Buddhist temple you will see there a big dome at the top of which standing a conical type of structure. If you go to the religious places, you can find various arts carved

on the walls, doors, windows and floor. When you go to
the garden, you can see the flower bed laying different
geometrical shapes such as triangular, rectangular, squared,
circular, and oval; tree branches signifying angles and also
can you see different patterns in the flowers.

(All the students were sincerely lending their ears to me.

They were very curious about this new type of excursion because they have never

gone for such an excursion before. One student, Pranav raised his hand and asked a

question: "Sir, such mathematics is not in our syllabus. Why shall we study such by

visiting various places? On the other hand, such types of mathematics are not asked in

our exams. Will you ask the questions related to our today's visit in the exams, sir?"

I had, in fact, expected such questions from the students and Pranav, the first boy of

the class, brilliant in mathematics, raised the question. I then clarified it to him).

"Pranav, I have expected questions from you and you did it. But your question is

oriented to exam. As I usually tell you all in my classes that getting higher marks in

the exams and getting knowledge/ concept of mathematics are interrelated to each

other but there is a vast difference between them. You may get higher marks without

full concept by doing regular practice and it is not worthwhile to you if you don't

have its sound knowledge or conception. You can do nothing in your practical life

without its real meaning. You know mathematics is originated from the cultures of

human beings all over the world. For example, tomorrow we will go to the old market and ask some shopkeepers about *dharni, mana, pathi* and find its history….”

(Pranav intercepts: “Sir, they are not included in our mathematics.” And I reply)

Again you are signifying to the exam, my dear! Ok listen, everybody! Do not be too much exam oriented! You must have the knowledge and concept of mathematics. Be contextual mathematics learner. I’ll give you one example: You know that there are three systems of measurement of angles: they are sexagesimal, centesimal and radians. We follow all of them, however mostly sexagesimal one. And it is not a surprise to you if I say that centesimal measurement is due to French and no doubt that they prefer to use their own. Moreover, foreigners prefer to use pound system of measuring weight but we are using kilograms.

(I wandered front and back in the room and the students are patient to listen to me)

I insist that Chinese, Korean, Japanese are using their own language in their country and they are the most developed countries in the world. If our curriculum does not include mathematics of our type from our cultures, at least we can study some subsidiary knowledge of mathematics besides the academic mathematics. Moreover, I have found from you pupils that some think why to learn mathematics and they fear of mathematics. I suspect that students like Megha are also the victims of learning such mathematics.

(I paused for a while and gave a glance at Megha. She smiled and I continued)

But I am sure that all of you will enjoy learning mathematics after this excursion when you experience that mathematics is not rigid, it is flexible to find in any places and cultures of our society and it is also of our type.

(One girl Atithi raised her hand and asked a relevant question: “Sir, will you please explain how we find mathematics in bridges?” I continued)

Atithi, there are many mathematics in the bridge. Oh! Can anybody tell me some?

(They whispered each other. Some voices came out unclear but one voice is clear. "Sir, we can find cuboidal objects such as bricks, the bridge may be itself rectangular" said Sauravi.)

Anybody, find more? Come on, try! You are going to face it tomorrow on the spot. If you do not interact here how would you find it out there? ….No ones? You Pranav, tell some! Umm…you Sandip, you also try! (Pranav said, "Sir, its railings on two sides are rectangular. They are long. The bridge has its fixed length. It covers a fixed area." I could see his knowledge fluency.) And Sandip! Can't you try?

(Sandip stood slowly and smiled: "Whatever I wanted to tell, Pranav told all. What shall I tell then, sir?" Whole class roars with laugh. I also could not stop myself from laughing)

Sandip, you're funny…humorous….please, sit down! Ok class, hold on! Please settle down! Now remember what I told you in the class before exam when I taught the chapter "Inequality". I have explained to you all its application in bridge.

(All whispered each other. And this time a quiet girl Astha stood and said, "Sir, the inequality is used to signify that load more than 1 ton is not allowed" I went near her and patted on her head praising her retaining capacity.)

Very good, I appreciate you that you still remember it. Class, do you know this expression? How I had written and explained it?

(I wrote it on the whiteboard as: x < 1 ton where x denotes the load)

If it is written on the bridge, then what do you understand? In fact, this algebraic representation tells that the vehicles carrying the load more than 1 ton are prohibited to cross the bridge, because there may be a risk of collapsing the bridge due to overload. Only the vehicles carrying the load less than 1 ton will ensure that the

bridge won't collapse. See how algebra is contextualised? ….. I am worried for you

do not remember the application of mathematics which I frequently tell you in the

class rather you focus on academic mathematics for the sake of getting marks in the

exams. It's not fair, my lovely children!

(Everyone took out their tongue and took a long breath as if they felt guilty.)

Look, this is the mathematics you are learning right now. You are technical, not

practical. However, taste the real flavor of contextualised mathematics tomorrow. I

think you also taste it now, am I right, class?

(Whole class speaks: "Yes, sir!" I continued.)

Can we find more mathematics in bridge? Anybody!

(Silence in the class!)

Ok, I give you ten minutes time to list some. From each desk, collect some and tell

me.

(Whole class began to interact to each other. Noise slowly rose. We all the teachers

sat together and had some conversations. Ten minutes later, I asked them to stop)

Ok, stop! Did you find some more mathematics in bridge? Ok, from the last bench!

(No one replied from the last bench. I gradually asked to all the benches from back.

They were unable to tell any. I then began to tell them some)

Listen! Couldn't you find that the two railings are parallel to each other?

(Whole class roars: "Huh……….")

Others you will find tomorrow, ok? Now we move onto the trees. What can you find

in trees?

(Voices come from them: "Angles….")

Very good!... Others!

(They whispered, I could hear their noise raising. Another quiet boy Manish stood and said, "Straight lines, sir"

That's true. More!

(A girl second in the class known as shy-girl Nainsu raised her hand and said, "Many branches are like straight lines and they are intersecting each other forming many angles."

Excellent, Nainsu! You are great! But why were you so quiet for a long time?

(I wandered to the last bench and encouraged the boys to find some. Finally, Kiran said, "Cylinder sir. The trunk of the tree is like a cylinder."

Marvelous, Kiran! I knew that you could say it!

(I walked to another bench filled with girls.)

Ok, you beautiful girls! Did you find any in trees?

(They just looked into each other's eyes. Couldn't say any! I then rushed to another bench of girls. Neha said, "Some branches may have intersected each other forming triangle."

Very nice, you lovely girl! You are genius! You can also find polygons if more than three branches are intersecting. They may have formed some kind of pattern as we see the patterns in the sky. Some branches may be like curves and so on.

(I then went to the front and drew their attention towards me)

Similarly you can also find much mathematics in towers and buildings. We did not discuss on them today, because I thought that they are familiar to you. (Pause) ….Ok students! I think it is better to stop our discussion over here. The remaining mathematics you will find them tomorrow. Now I think that you have got a clear idea about what to do tomorrow in the excursion. I hope that today's class was fruitful to you and will be helpful for tomorrow. Ok, class. Did you enjoy today?

(The whole class roars: "Yes, sir!" I concluded the class.)

(Background Music On: whistle blow is heard and stage light is off)

Episode 3: Experiencing the Culturally Contextualised School Mathematics

Education III

Whistle Blows

STORY TELLER-RESEARCHER (Background music is on)

It could be any Saturday of May 2010, usual public holiday for all the teachers. At home, I was alone in my room. The room was full of scattered stuffs: books hither and thither. Desktop of the computer was on with a song. Laptop on my lap! I laid on the bed, closed my eyes and started to review my teaching practices! I was writing my reflection on my mind. I had been trying to apply my knowledge of teaching practice learnt from Kathmandu University to the students of my currently working school. My thinking-rethinking upon my ideas was in a full swing. And my two and a half

year old daughter Atithi came into my room despite of my denial. She asked some blurred questions and tried to draw my attention but I was trying to concentrate on my objective. Later on, her mother took her out of the room.

Serving as a secondary mathematics teacher in the school for more than two decades, I came to realize that mathematics what I have been teaching is mostly exam-oriented. Most often the students ask me the important questions during the revision time just before the exams. I cannot stop myself from giving the important questions to the students because I know that our curriculum is guided by the Habermas' technical cognitive interest mostly (It also provides the wisdom of practical cognitive interest though) and the school wants the result. I then taught the students as products in a controlled and managed environment and gave them the knowledge and concept of mathematics. In this situation the students used to listen to me carefully in a pin drop silence classroom and then practice the problems alone. But it was not worthwhile and then I turned into creating a particular environment in which students were encouraged to understand the meaning of mathematics by having interaction between the students and me. I did not managed and manipulated the environment that I created in the classroom rather I left the students to interact to each other and me as well. They were focused on understanding. I divided them into groups and applied the cooperating learning among students. Finally, it was proved that students understand the meaning of what they wanted to learn in mathematics. It was milestone of my teaching practice. I observed that the students were eager to learn more and were asking for more questions to solve in the same situation. Later on, I asked some questions randomly whether they were able to get the knowledge and concept or not. All of them were able to understand.

Now it was time for me to apply my plan of applying the contextualization of mathematics in the classroom. I knew that it was only possible if I would create an environment inclined to the Habermas' *emancipatory* cognitive interest. I was trying to apply contextualization of mathematics as a tool for understanding the meaning of mathematics by creating an suitable environment influenced from emancipatory cognitive interest so that every student interact critically to each other and the teacher. For that, I asked randomly some questions relating to the practical application of the lesson in our daily life. They were stunned. No one could say anything. For example, I asked them to contextualise *function* to our daily life. Nobody was able to do so. I then realized that I must do something new in the teaching practices so that students are free to think and interact to each other to construct knowledge in the classroom. I promised to myself to apply the method encouraged by Habermas' emancipatory cognitive interest so that the pupils are free to interact to each other and teacher critically in the context of our daily life to construct knowledge. And I chose *function* for my topic of teaching in class 9.

In the very next day I came up with a lesson plan encouraged by the Habermas' emancipatory cognitive interest (perhaps some aspects of it!). The objective of my lesson plan was: *To define a function by contextualizing it into our daily life.*

I then divided the 30 students' classroom into five groups and asked them to choose their group leader and hence highlighted the objective of today's mathematics learning. I wrote the topic and objective on the whiteboard. I gave them 30 minutes for discussion encouraging them to think and rethink critically to construct knowledge. After 30 minutes, each group had to tell their outcomes and I would note all the points on the whiteboard and explain to them. I provided them the necessary

materials such as chart papers, sign pens, glue sticks, etc. The students were ready for the interaction in an open environment of the classroom.

Now I could see the students in their respective group actively interacting to each other. I wandered from one group to another and shared my knowledge with them. They asked me many questions some of which were irrelevant to the context too. As I had already taught them how to contextualise mathematics into our daily life, they had some idea of it but here they were not able to link function into our daily activities. I then gave them some idea and asked them to explore more from their side and they did it. Finally it was time for telling their outcomes. Each group present their outcomes and I noted them down. The bell rang in the middle but I allowed till they could finish. I left my concluding part for tomorrow. I asked them to paste all the chart papers on the wall.

The following day I entered the classroom. It was time for conclusion. All the students stood and greeted me. I then looked upon their chart papers, reminding them yesterday's interactive class. They were eagerly waiting for my conclusion. I then started to explain.

"Do you think that yesterday class was fruitful to you?" asked I a simple question to begin with.

Whole class roared: "Yes sir!"

"First of all, I want to congratulate all of you for your active participation in the yesterday's class. It was awesome! All of you were interacting to each other in their respective group; asking questions to each other and me too. There was no any interruption from anywhere. Wasn't it, class?" expressed I with passion my view-point and expected for their response.

Whole class shout at one voice: "Yes, sir!"

(I could read on their face the state of satisfaction as they had never been involved before in such type of interaction. Studied in the controlled environment before, as if they were refreshed now and could stretch the wings of their body and prolonged their tongue.)

"Very good, my students! Today I am going to explain how you contextualize the concept and meaning of function. Let me start the conclusion incorporating the outcomes of all the groups. First of all, let me take some relations to define a function from the set A to the set B" started I telling my conclusions.

(I then wrote the two sets A and B and four relations f_1, f_2, f_3 and f_4 from A to B.)

"Let A = {a, b, c, d} and B = {1, 2, 3, 4} be the two sets.

Let me define four relations f_1, f_2, f_3 and f_4 from A to B as follows:

f_1 = {(a, 1), (b, 2), (c, 3), (d, 4)} f_2 = {(a, 3), (b, 1), (c, 2), (d, 3)}

f_3 = {(a, 1), (b, 2), (c, 3)} f_4 = {(a, 1), (b, 2), (b, 3), (c, 4), (d, 4)}

Now let me represent these relations in arrow (mapping) diagrams and we study their nature on the basis of the following two points:

(i)   Whether each element of first set A is used in pairing with the element of second set B or not.

(ii)   Whether each element of first set A is paired with a single element of second set B or not.

(I drew the arrow diagrams of all the four relations f_1, f_2, f_3 and f_4 as shown in the figures. I then drew their attention and begin to explain with the help of figures.)

Look, in this fig I, all the elements a, b, c, d of this first set A are used in pairing with any one element of that second set B and no element is paired with more than one element of set B.

Here, the relation f_1 satisfies both of the above conditions.

Similarly, check in this fig II, the relation f_2 also satisfies both of the above conditions.

Is it or not, class?" asked I, turning to them.

Fig I Fig II Fig III Fig IV
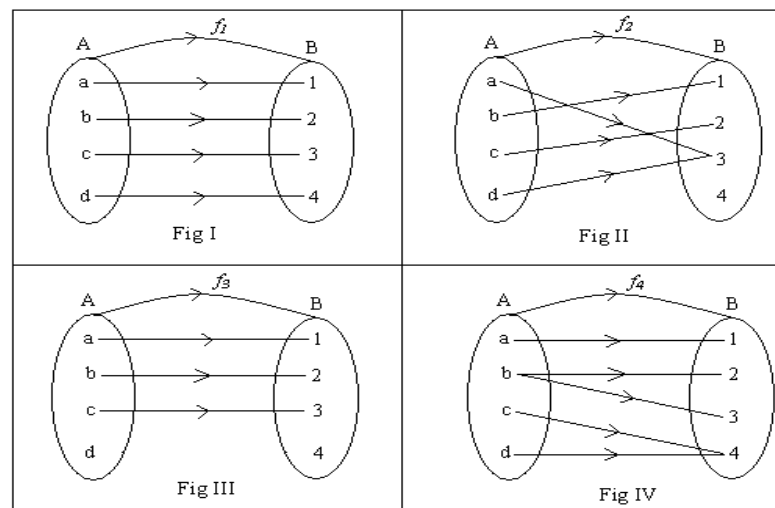
(They concentrated on the figure for a while and roared: "Yes, sir!" I then continued my explanation by drawing their attention time and again in between.)

"Now it's your turn to tell which condition is not satisfied in this fig. III?" asked I them to find it and waited for some time. When they couldn't, I gave a hint:

"Do you notice here that this element d of the set A is unpaired? Now tell which condition is not satisfied, class?" asked I so that all of them should get involved.

("Second condition, sir!" roared the whole class)

"Good! Now can you find which condition is not satisfied in fig. IV? Take your time."

(I allowed them to observe the figure for some time. No one replied for some time. One girl Abhigya stood with answer and its reason and said, "Second condition, sir, because the element b is paired with two elements 2 and 3.")

"Wonderful, Abhigya! You could notice it. Class, did you get it?" asked I to the class after praising Abhigya.

("Yes, sir" one voice of the class)

"Now we again go back and summarized what we found. The relations f_1 and f_2 satisfy both conditions while f_3 and f_4 not. Then I claim that f_1 and f_2 are functions while f_3 and f_4 are not functions but they are simply relations. So, *a function is a special type of relation.* Then, can you define a function? Once you try."

(I let them interact for some time. Some of them tried and then I told them the definition)

"As I told you that a function is a special type of relation satisfying both of the above conditions, then we can define it as follows: A *function* from a set A to a set B is a relation or a rule that associates each element of A to a unique element of B. Do you get me, class?"

(Everyone was happy to get the concept of function. Now I had to discuss about its meaning in the lifeworlds with the help of its contextualization)

"Ok, class! Now we discuss how we can contextualize function with our daily life. Can you tell any one example?"

(They whispered each other but couldn't tell any. Gradually noise rises)

"Ok, hold on, maintain your silence! I will tell you two examples. After that you find some more examples, ok?"

Whole class agreed: "Ok, sir, we will try."

"One example is pulling a trigger of a pistol. When you pull the trigger of a pistol, then in each time one bullet comes out. This "pulling action of trigger" a function."

(All the students surprised. I then told them another example)

"Another example is from the rice mill. Do you know how rice is produced from paddy?

In the rice mill, when grains of paddies are poured into the mill, pure grains of rice are

obtained, provided that each grain of paddy (*Dhaan*) should produce one grain of rice (*Chaamal*). This action is also a function. Now I am going to explain you both the examples with the help of figures"
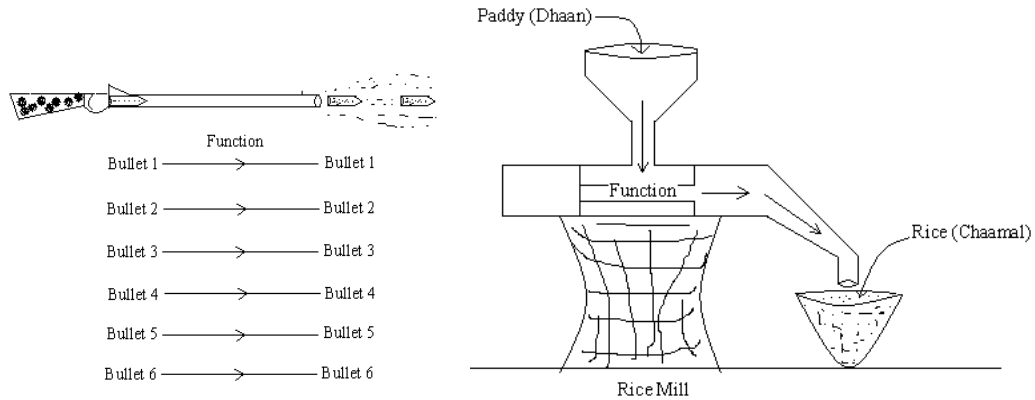
(I explained both examples and told them how mathematics is contextualized. I also told them that the mathematics we are learning is originated from the cultures all around the world. Finally I gave them the homework to collect such more examples. The bell rang.)

(Background Music is on: Whistle blows and stage light is off)

Discussion and Chapter Summary: Speaking as a Researcher

The whole Chapter III revolves around the subsidiary question numbers 2-4. I have tried to give the glimpses of contextualization of culturally decontextualised mathematics in my teaching and learning mathematics and my transformation from technical to practical and emancipatory teacher/learner.

Episode 1 lays an impression that teachers are unaware of contextualization of mathematics in their teaching practices which I have depicted as a teacher trainer through workshop. I have portrayed here how a teacher can link the culturally decontextualised mathematics to the cultures of their students and encourage them for learning mathematics. I also attempted to give some practices of ethnomathematics as

a beginner in the Act II. Here I have tried to link cultural mathematics with ethnomathematics and encouraged the teachers for further inquiry.

Episode 2 depicts my teaching practice on contextualisation of mathematics in the classroom. I have tried to dissect the academic mathematics by raising the issues through the students. Here also I have encouraged the students to link mathematics to the contexts in and around them. I have convinced the students about the advantages of contextualization of mathematics in learning mathematics by raising various issues such as their dejection towards mathematics, exam-oriented method of learning, future career in mathematics, etc. I have depicted that new type of excursion of mathematics teaches them to explore about the possibility of mathematics in their culture hoping that it will help them learn to do a mini-research on mathematics related field. I also tried to portray here that active participation of students in the classroom interaction help them learn mathematics easily.

Episode 3 is fully centralized to portray the three fundamental human cognitive interests of Habermas. I have created three situations through narratives and dialogues and depicted how these three cognitive interests, namely technical, practical and emancipatory lay impressions in pupils' learning of mathematics. Here also I have depicted how mathematics can be contextualized in relation to our cultures of daily life. I have also applied cooperative learning in the classroom situation to portray how interactive class can be fruitful in learning mathematics.

Over all, I have tried to explore how culturally decontextualised mathematics education can be contextualized in schools through cooperative learning and in the perspective of ethnomathematics. I have tried to interpret the problems through students to make meaning of learning mathematics and portrayed to show how knowledge is constructed in the interactive classroom.

Through this chapter I have tried to lay the possibility of contextualization of mathematics in and around the students' areas. I also have tried to portray that mathematics can be found everywhere as it is like a daily meal of human beings. The only thing is that one should have interest in learning mathematics which is aroused by the way they learn the contextualized mathematics.

In this chapter, I have stressed on reform of curriculum directly/indirectly with the help of drama by creating some situations and awareness in students and teachers. Even in the United States of America the reform movement in mathematics education was carried out in the midst of 1980's and was a response to the failure of traditional teaching methods. Battista (1999) states that in new mathematics,….. students must be able to read, write and discuss mathematics, use demonstrations, drawings and real-world objects, and participate in formal mathematical and logical arguments. If it is so, then why not our nation seeks for reform of mathematics fitting to our soil: our culture?

Finally, in this chapter my aim was to give the flavor of the Habermas three cognitive interests. Habermas technical interest focuses on structuring and managing objects and the environment. In these terms the function of curriculum is to define and control student learning. The outcomes of the experience of the curriculum are viewed as tangible products, and conform to the teacher's original intentions for it. On the other hand, a *practical interest* (where I situate myself) aims at reaching an understanding that enables appropriate action to be taken. It aims to analyse and clarify human experience, uncovering meanings, prejudices and presuppositions. The student and teacher interact to make meaning of the subject matter, thus equipping students to act on these meanings. Teachers with a practical cognitive interest are concerned that interactions in the learning environment provide appropriate

opportunities for learning. The teachers are researchers of their own practice, with skills and commitment to study their own teaching and test theory in practice. Finally, an *emancipatory interest* (where I hope to have situated myself) strives for empowerment, rational autonomy and freedom, emancipating others from 'false ideas, distorted forms of communication and coercive forms of social relationships which constrain human action. The end result of emancipatory interest is 'a transformation of consciousness in the way one percieves and acts in the world (Fraser & Bosanquet, 2006). On the very basis of three cognitive interests, I conclude that learners should be active participants in the learning programme; the learning experience should be meaningful to the learner; and learning should have a critical focus (Grundy, 1987). In writing this chapter it was like to bite a flesh for a hungry tiger while presenting all my knowledge into narrative form with an art-based look. This chapter was to be shaped in such way that it could reply all the questions raised by culturally decontextualised mathematics education which I portrayed in the last chapter II. I was stimulated and eager to collect and present in a compact form all the experiences that I had learned throughout my teaching and learning practices and finally I could be able to do so. I learned how to present dispersed knowledge into concise form artistically so that it could be presentable and readable with some morals. Turning the pages of chapter II many times, reading it and understanding what message I wanted to depict actually enhanced my writing this chapter III in such a complete form.

While writing the chapter III, I situated myself as a critical thinker supporting the Habermas' two cognitive interests namely practical and emancipatory. It was very hard to pour my opinion through narratives in dramatic way: my feelings and emotions had to be run smoothly parallel to practical way of thinking. Sometimes emotions and feelings overshadowed practicality but immediately I pulled myself

back to the right track so as to give real sense of testing my ability of presenting what I intended throughout the chapter. However, my culturally embedded soul and mind supported me to bind myself within the culture of inquiry which is attached to culture of autoethnography closely guided by Habermas' technical, practical and emancipatory interests.

The stories in this chapter really dragged me into my past and present lifeworlds where I experienced so many suffers and bitter facts such as distortion and coercion against my noble works. But after completing it successfully I found myself standing in the midst of shadowed milieu of education lighting a candle of "contextualisation of culturally decontextualised mathematics education". This chapter also took me to my future directions where I could now see a brighter future in the field of research study. Though I am a novice researcher, I find myself now that I have got a golden opportunity to grab the first tip of the rope which is linked to the wide field of research inquiry. I have got courage and confidence that I could also be a researcher in the days to come with my full effort.

Again a question is raised from my insight, what did I learn after writing this chapter? I learned much knowledge regarding expressing my feelings and experiences in an artistic way using auto-ethnographic genre of writing. The heart of these stories are completely influenced by my personal experiences which I have tried to link to others' lifeworlds as I am a creature from the same society. I was a creator and I am a destroyer; I was a destroyer and I am a creator. I am a character of human rationality. I am radical and a critical thinker. I have to live in the same world where others are living. I have to be a positivist teacher and learner and to be a constructivist. But I have to construct/deconstruct knowledge; I have to reform the education system in my country; if I don't, there should come somebody forward to do so; I mean, anyone

will certainly come front sooner or later for the betterment of human society in Nepal. Then, what did I learn? Anyone can now guess it: these all what I learned to express my views and I could transform myself into a professional learner, teacher and researcher.

Another strong learning is that I could become a playful in writing own stories by connecting them to others life stories. My stories may act as metaphors to supply the bundle of messages (new knowledge) to readers (students, teachers, educators and educationists) who wish to get rid themselves from coercion and deceit of culturally decontextualised mathematics curriculum of Nepal and eager to transform into critical thinker for the sake of meaningful mathematics learning in school, colleges and universities.

CHAPTER IV

My Learning and Reflection
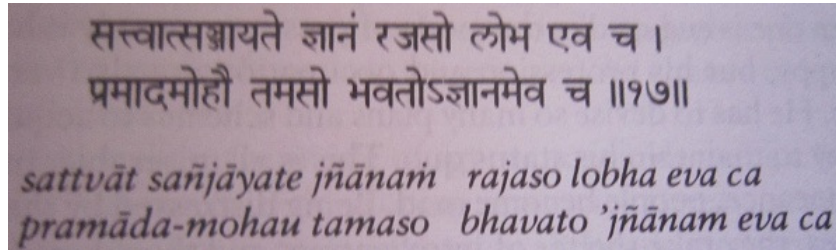
Trans: From the mode of goodness, real knowledge develops; from the mode of passion, greed develops; and from the mode of ignorance develop foolishness, madness and illusion.– Bhagavad Gita

This chapter reveals, in brief, what I explored after I completed this research study. It also incorporates my experiences of learning and teaching from early childhood to till date.

As my research study progressed gradually, I as a beginner in research field read various books and articles related to research (quantitative but qualitative mostly) for many days day to night. Finally I came up with a certain framework and began my research study. In progress of my research study there were so many mental and technical hindrances challenging me absurdly. Mainly I was in a quandary in capturing the literature central to my research design. I had already made up my mind for adopting an autoethnography genre of writing on the theme of my journey of learning and teaching and it was like a tussle for me to transform my learning and teaching from culturally decontextualised to contextualised mathematics education. I had to first fight against my inherited conventional learning and teaching habits. After joining Kathmandu University, I took u-turn from that inherited habit theoretically (mentally) which is the result of my research study. It was though easier for me to

transform as a learner but very difficult as a teacher, because as a learner I was convinced at Kathmandu University during my academic tenure; as a teacher it was not as easy as one critically speaks out of reforms of curriculum rather I had to face many upcoming challenges. During my research journey what I found was that the curriculum in Nepal is mostly influenced by the politics (Luitel, 2007). I also found that syllabus provided by the curriculum is mostly inclined to the Habermas' technical interest (but one can feel that there is some flavor of Habermas' practical interest). But it was very difficult to change the curriculum rather I had to change my teaching pedagogies/methodologies. For that, I had to prepare suitable environment in the classroom but the classroom belongs to private owners and the private owners are central to business of education in the name of social services. This scenario was a complex situation for me and I had to fight against these by taking them all along with the process of transformation of my teaching.

My hard work paid me after all! I could establish my wished environment in the school through my trainings given to the primary and lower secondary teachers of the currently working school. My transformation of teaching thus began from giving trainings from 2008. Though it was very difficult for me to apply it, gradually the teachers were convinced with the help of the school Principal and management. The journey of these trainings from 2008 to till date gave me much support in this research study as I could transform myself to a contextualized teacher, more precisely a constructivist teacher influenced by the Habermas' practical and emancipatory cognitive interests. For a constructivist educationist, knowledge must be actively constructed as the learner is an entity with previous experiences that must be considered as a "knowing being" (Fosnot, 1996). Learning is therefore seen as an adaptive and experiential process rather than a knowledge transference activity

(Candy, 1991). In this regard, I merged my practice of informal cooperative learning as a student into my social constructivist teaching practice. So far I have understood, the theory of social constructivism implies that teachers encourage children to talk about their mathematical understanding. Social interaction is emphasized since individual children construct their understanding through talk and interaction with others. Sharing of ideas and meanings are negotiated with others (Worthington & Carruthers, 2003).

I could then apply my teaching practice of formal cooperative learning in the classroom and I was able to apply my idea of contextualization of mathematics. I could understand myself that I would not be able to contextualize the whole curriculum; I gradually sprinkled the fountains of "contextualisation knowledge" onto the mind of the students and teachers starting from a few chapters which could be easily linked to the cultures of their society. The practices I have done in schools, colleges and Universities as a learner and the practices I have done as a teacher or a teacher educator in school laid basic foundation of my research study.

My journey of this research led me towards a critical thinker from a casual one. My teaching profession before was only the means of earning for day and night fodders. But my admission in Kathmandu University really ignited my passive

knowledge and thoughts and henceforth my desire of learning aroused to the right direction. Throughout this research study I could build up my confidence to claim that "Yes, I can do it!" As a child learner I still remember of early childhood (or reminded by my mother as my father is no more since 2001) when I used to play with my friends some

mathematical games such as *baghchaal, ekalkhutti, kabaddi, cockfight, bullfight, pebble-games, etc.* I was grown with various geometrical shapes and objects such as *kuto, kodalo, halo, doko, nanglo, pira, gundri, etc.* in my culture of society.

I learnt from my parents to weigh rice, pulses and corns by using our local system of measurement such as *mana* (1 kg is equivalent to approximately two and a half *mana*), *pathi* (8 *mana* is equivalent to 1 *pathi*) and *muri* (20 pathi is equivalent to 1 *muri*). I also learnt to measure the land by the local system of *bigha*, *kattha* and *dhur*. One interesting mathematical guessing I could never forget in my life is that my father was able to tell an approximate time by measuring the length of shadow of a vertical stick on the ground. I also remember his predictable power whether it rains or not and accordingly we were asked to cover or not our crops to prevent them from rain just by observing and analysing the movement and darkness of the cloud in the sky. I also remember those carpenters guessing the length of log of woods in feet with their hands. My friend Rudra was accurate to hit a bird resting on the branches of trees with the help of catapult. His accuracy was wonderful. So many experiences I recalled and merged into my teaching-learning process of contextualising mathematics, though all of these I could not embrace here in my thesis. However, these entities were regained in my mind throughout this research and became resource materials.

In course of transformation, I linked academic mathematics to my early mathematics and mathematics taught by parents and culture of my society. Therefore, this research study helped me explore my early mathematics and mathematics taught

by parents and culture of my society and also encouraged me to contextualise the decontextualised (academic) mathematics in my teaching and learning practices. Some of my friends in the middle school and secondary school were distracted from mathematics learning. I still remember that one of my village friends failed in mathematics subject in the SLC examination and then he was dropped out by their parents from getting further education. Some middle school friends left the school due to the fear of mathematics. When I encounter them now-a-days in the village, they call me "Bookworm, mathematics-worm". Though there are so many events, I could capture only a few in this research study so far.

I have pin-pointed in this research study that the inclusion of culturally decontextualised (pure) (Luitel, 2009) mathematics in our curriculum might have compelled students to follow the method of rote-memorization rather than understanding the meaning and concept of mathematics. And my attempt was to portray this view-point through autoethnography genre of writing in the narratives and textual forms through drama, stories, poems and visuals. As a possible solution of this problem I depicted the scenarios of contextualization of mathematics throughout this research. I also portrayed the situation of a fear of mathematics due to the conventional method of teaching in a controlled environment (through sticks). As a possible solution for this problem I created the environment in the classroom inclined to the Habermas' practical and emancipatory cognitive interests and applied the method of cooperative learning and constructivism in my teaching practice.

The whole chapter II is focused to portray the situations of decontextualised mathematics. Throughout the chapter, I have tried to portray that the informal cooperative learning helps students in learning mathematics. I have tried to give the message that teachers have to follow this cooperative learning in the classroom.

Gradually the character "I" in the drama (chapter II) grows, so does his attitude change and becomes a critical thinker in college level. Moreover, I could transform myself to a critical thinker after I admitted to Kathmandu University.

Above all, throughout my research study I have tried to portray a new avenue of contextualised mathematics for me, teachers and students by linking decontextualised mathematics to the culture of our society. Finally, I would like to be called me as "a contextual teacher-learner acquiring critical thinking".

As a learner and teacher, I find myself as a constructivist teacher whose ways of thinking is influenced by the Habermas practical and emancipatory cognitive interests. A *practical interest* aims at reaching an understanding that enables appropriate action to be taken. The student and teacher interact to make meaning of the subject matter, thus equipping students to act on these meanings. Teachers with a practical cognitive interest are concerned that interactions in the learning environment provide appropriate opportunities for learning. An *emancipatory interest* strives for empowerment, rational autonomy and freedom, emancipating others from 'false ideas, distorted forms of communication and coercive forms of social relationships which constrain human action. The end result of emancipatory interest is 'a transformation of consciousness in the way one percieves and acts in the world (Fraser & Bosanquet, 2006).

As an implication, I depicted that linking mathematics to the culture of society evolves ethnomathematics. I created a scenario through math workshop which encouraged teachers to explore the possibility of inclusion of ethnomathematics in our curriculum. So, I cannot remain idle without evoking that *ethnomathematics* is a program which helps students linking their academic mathematics to the mathematics practiced and being practiced in their own cultures. Ethnomathematics is particularly

concerned with real contents, and it comprises as *ethno+mathema+tics(techne)*. Thus, it is not inappropriate the coincidence of the choice of the word Ethnomathematics with Mathematics in its modern acceptation, as practiced in the academy and in schools today (D'Ambrosio, 2006). I accept Orey and Rosa (2004) saying that "a basic tenant of ethnomathematics is the sincere belief that all peoples use mathematics in their daily life, not just academic mathematicians. Yet, globally speaking, all people do not have regular access to or do not attend school. Ethnomathematics as a program of study offers one possibility – allowing researchers to examine what and how we teach mathematics in context of the school, culture and society." Therefore, I support that ethnomathematics as a programme may be introduced to Nepali curriculum of academic mathematics.

Considering especially the research question 4, it is my transformation into practical and emancipatory teacher and learner. Moreover, I would like to advocate that I am more likely leaned to critical teacher and learner because I want a transformative education system in Nepali schools so that students can freely interact to each other and to teachers for knowledge construction. At this stand-point, I want to highlight the critical theory. "A critical theory wants to explain a social order in such a way that it becomes itself the catalyst which leads to the transformation of social order (Fay, p. 27, In Brookfield, 2005, p. 7). One of the strongest hopes of critical theory is that consideration of its understandings will prompt social and political change, often a revolutionary nature. This theory helps us understand not just how the world is but also how it might be changed for better (Brookfield, p. 7). Then, I have envisaged the need for reform of mathematics educating system in Nepali schools for better and I have found myself feel proud for the reason that at least I have taken an initiative in this regard by transforming myself into practical and

emancipatory teacher and learner so as to make mathematics more meaningful to students lifeworlds.

As I have dealt with five key points in Quality Standards: (a) *Research as/for consciousness raising,* (b) *Research as/for professional development,*(c) *Research as/for reconceptualising self,* (d) *Research as/for socio-political action,* and (e) *Research as/for pedagogical enablement*, I am very much sure that these are my assets for future study as gained after completion of this grand research inquiry. These five sets of quality standards judge the qualities of my research study throughout the inquiry and must probably shape my future direction in the field of research study and inquiry.

Reiterating My Research Aims

My journey of inquiry began with the excavation of my own biography as a student and teacher. Later on, I have included that I have also passed my journey as a teacher educator in school. I generated my research questions on the basis of my history as a student of primary, secondary and college level in Nepal and my professional experiences as a teacher educator in the schools of Nepal between the years 2008 till date. This autobiographical extract helped me explore the hegemony of decontextualised mathematics education in Nepal and hence I found that mathematics is a foreign subject; mathematics is a body of pure knowledge (Luitel, 2009); fear of mathematics; distraction from mathematics and drop-out from mathematics learning. Assembling these images in heart and mind from early education to secondary education, it was rooted into my heart and mind till college level just before I began my journey of learning at KU. After joining KU, I began to search my new avenue of learning and teaching mathematics. There were many twists and turns in my journey of teaching and learning. However I managed to

implement my purposes of contextualization of mathematics culturally in my teaching practices and hence I could transform myself into the practical and critical teacher-learner from the technical one. Despite the narrow and infallible nature of teachers' perception towards mathematics in schools I was able to stir their brain through my knowledge of pedagogic experiences and hence ultimately they were able to except to transform their view-point of the academic mathematics as a pure body of knowledge into contextual mathematics. It was a genuine paradigm shift for me from the Habermas' technical interest to the practical and emancipator cognitive interests.

Writing and rubbing many times I could culminate four research questions and finally confined myself to those research questions to explore my research study through autoethnography with the support of small p philosophical inquiry and living educational theory into the culturally decontextualised mathematics curriculum with the help of the Habermas' three cognitive interests: *technical, practical* and *emancipatory*. Through cooperative learning as means of learning I unpacked the nature of academic mathematics as a body of pure knowledge onto the brains of students and teachers and encouraged them to construct a new knowledge as constructivist learners and teachers respectively. That was also my stepping stone of transforming me into constructivist critical teacher who is now not just confined to feeding knowledge to the students as products. While articulating the nature of mathematics as a body of *pure* body of knowledge, I tried to interpret the term *pure* with the term *predetermined knowledge* based on algorithm and rote-memorisation method (e g. practice) which in turn was unable to incorporate the mathematics arising from students' lifeworlds in mathematics teaching learning activities. The above discussion comprises the answers to the research questions 1, 2 and 3 in which

I as a culturally decontextualised teacher and learner could transform into 'practical' and emancipatory teacher and learner.

To respond to the research question 3: *"How can a culturally contextualised mathematics education enable meaningful learning of mathematics?"* I moulded myself into a character of cultural component by bringing the existing cultural issues of students and teachers into the classroom. Moreover I could be able to discuss the issues related to ethnomathematics in the classroom with teachers and students directly/indirectly to explore its possible inclusion in the current school mathematics curriculum of Nepal. It helped me to claim that I have now become a critical thinker regarding the prevailing decontextualised mathematics of Nepali curriculum and became a candidate in the side of reform of current curriculum.

Above all I have done full justice to all the four research questions in my whole research study by accumulating multidimensional ideas and knowledge gained through my teaching-learning experiences and practices by decorating them with philosophies, paradigms and pedagogies and was able to construct a transformative vision of mathematics curriculum (Luitel, 2009).

Implications for Others and Myself

I agree with Luitel (2009) that If I do not speak about possible implications for others (i. e. the mathematics education community, curriculum committees, teachers and teacher educators), I may be termed as narcissistic who is overly concerned with his own self-pride and self-interest. Nevertheless, my implications need not be conceived as full and final assertions, rather they can offer a set of insights into the problem of culturally decontextualised mathematics education faced by students in Nepal. In an effort to construct visions for addressing the problem of culturally decontextualised mathematics education, I envisioned that my vision of

a multidimensional image of the nature of mathematics as a body of pure knowledge can become a key orienting nature of mathematics for conceiving much needed inclusive pedagogical and curricular spaces for mathematics education and such vision of curriculum can become a basis for incorporating different forms of knowledge system from both contextualised and decontextualised mathematics.

Truly, what I articulated as possible implications for others can also be implications for myself for my future teaching-learning practice because I also belong to the group of 'other' people: a student, a teacher and a teacher educator.

My Future Research Direction

As a novice researcher, I should deepen and strengthen my research study in a broader form in my further M. Phil. Study. I am now determined to continue my study further as I have got such a brilliant and cooperative dissertation supervisor Dr. Bal Chandra Luitel who was able to induce my passive knowledge in a short span of time (merely two months) and transform me into an active learner and researcher. I was sleeping in the world of passive recipients and eventually Dr. Luitel enlightened my blurred insight and thought and hence lit up the candle of my research study as a beginner. I know that there are much more to do ahead; I take it as a challenge and take over it perceiving that "*Hard work always pays you!*" For me, now history of mathematics is fundamentally open to change and liberation is an authentic goal leaving behind my old perception that mathematics as a body of *pure* knowledge; mathematics as a *foreign* subject (Luitel, 2009). My future direction is determined to explore more in the field of various natures and forms of decontextualised mathematics.

To do so, I agree with D'Ambrosio (2002) that now the time has come to do

some creative work for the people's mathematics, creative practices of mathematics in the social and cultural contexts. Ethnomathematics can be a door to view the people's mathematics in their socio-cultural context. The restoration of this in education is implicit in his proposal for a modern trivium in education: *literacy, matheracy* and *technoracy* (D'Ambrosio, 2002). The inclusion of ethnomathematics in academic mathematics can be lively mathematics to learn in the classroom so that students feel proud of valuing and giving accountability to their cultures.

My pedagogy changed from conventional to constructivist teaching and learning. My teaching practices were more focused as a teacher-centered and now I am more student-centered teacher and consider students as active participants rather than passive recipients in my classroom teaching and my future research direction will be guided by cooperative learning to construct knowledge by interaction critically amongst students and between student and teacher.

Finally, I would like to conclude this research journey with some questions to all the belongings: me myself, students, teachers and educators. "How did I practice my mathematics learning in the classroom? How did I practice my mathematics teaching in the classroom? How should I practice my teaching and learning mathematics in future? How should I incorporate mathematics practiced by people in academic mathematics? How should I explore mathematics inside and outside classroom teaching? How should I be guided by any philosophy to deepen my knowledge in mathematics? Which pedagogy(s) and paradigm(s) should I follow in my future research study? How should I inquire and explore knowledge in my future research study? How should I shape my future research study? Moreover, can I remain as a practical and emancipatory teacher and learner more leaned

towards the paradigm of critical theory all the way throughout my teaching and learning practices? Nevertheless, how can I make mathematics more meaningful to student's lifeworlds with the help of contextualisation of mathematics education? Before I conclude my journey of research study, I present a poem when my sixth sense is active to speak out about a victimized student by a teacher.

My sixth sense is active

My sixth sense is active:

A gentle whisper in my ears-

Education is a basic need

For a devotee as a learner and

One may be devotee in a passive state;

One may be a devotee in an active state;

One may be a devotee as a friend;

One may be a devotee as a student;

One may be a devotee as a teacher;

One may be a devotee as a parent.

My sixth sense is active:

A devotee is who devotes

Himself/herself to knowledge-sharing

And knowledge-construction.

A passive teacher costs on

A student's active participation

And in knowledge-building.

An active teacher can change

A student's ways of thinking-

"Mathematics is a body of pure knowledge".

My sixth sense is active:

A friend can engage a friend

In sharing of knowledge,

A parent can induce a child

For better education.

A gentle whisper in my ears-

A child can be victimized

A child can be distorted

But can be moulded

Into desired form

By a constructivist teacher.

Who knows a child can be

A teacher of the teacher!

_____._____

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