MY EXPERIENCE OF INCORPORATING GLOCAL KNOWLEDGE WITH SCHOOL MATHEMATICS

Dilkumar Maharjan

A Dissertation

Submitted to

School of Education

in partial fulfillment of the requirements for the degree of

Master of Education in Mathematics

Kathmandu University

Dhulikhel, Nepal

April, 2014

DECLARATON

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

Dilkumar Maharjan

Degree candidate February 2, 2014

DEDICATION

This work is profoundly dedicated…

To my lovely mother and late father whose inspiration and blessing have given me the strength to live my life.

To all my teachers who imparted their knowledge to live meaningful life.

To my lovely wife, Yamuna Maharjan, for moral, spiritual, nutritional, and syntactical sustenance during the long gestation of this dissertation

To my lovely son Devin whose face makes me to complete this thesis in time for his golden future.

To my younger brothers whose valuable support, reached in this stage.

To Kathmandu University school of Education which shaped by research journey.

AN ABSTRACT OF THE DESSERTATION OF

Dilkumar Maharjan for the Degree of *Masters of Education in Mathematics* titled "*My experience of incorporating glocal knowledge with school mathematics"* was presented on February 2, 2014.

Abstract Approved

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Amrit Bahadur Thapa

Dissertation supervisor

This dissertation portrays my life experience and exploration regarding my pedagogical practices as a student, as a teacher and a facilitator focusing on the use of glocal knowledge and artifacts in teaching and learning. I have comprehensively presented my learning practice of mathematics at school, colleges and University as well as teaching practices of mathematics at school level. Similarly, I have discussed about my learning experiences from different seminars, workshops and trainings. I have chosen auto ethnography as method and methodology of research and interpretive, critical research as a key research paradigm to portray my research study. Auto ethnography helped me to excavate experiences that I have gained in the journey of teaching and learning of mathematics. The interpretive research paradigm helped me to focus on action and begin with individual and set out to understand by interpretation of the world. The critical research paradigm helped me to identify my research problem, reflect upon my teaching and learning experiences and transform to new concept on teaching and learning of mathematics. In this study, I also used Post modernism which helped me to generate multiple genres of writing as poem, poster, narrative etc. These writings make my text wealthy and pedagogical thoughtful from my experience regarding paradigm of teaching and learning. In regard to theoretical

referents, I have used constructivism, social constructivism and different learning theories as my referents. My focal point of this research is my reflective practices as student, teacher and facilitator.

In the process of writing my episodes, I have tried to set my journey of teaching and learning of mathematics to show my extensive experience as a student situated in teacher centered and text book centered classroom from early school to college level of study. I have also attempted to use my teaching and learning experiences to make significant change towards a "student centered" classroom so that students can easily learn mathematics.

…… February 2, 2014

Dilkumar Maharjan, Degree Candidate

Masters of Education in Mathematics dissertation of Dilkumar Maharjan presented on February 2, 2014.

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

_____ February 2, 2014

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ACKNOWLEDGEMENT

This dissertation is the result of the assistance of many persons to whom I am greatly obliged.

First of all, I would like to express my gratitude to the almighty god for giving me the strength to perform my responsibilities as a researcher and complete this dissertation. Although many problems were enrolled to me during my work, I was able to reach this stage because there was a God who enabled me in every step of my life.

I would like to express my sincere gratitude and heartfelt thanks to my supervisor, Mr. Amrit Bahadur Thapa, visiting Faculty (Lecturer), School of Education, Kathmandu University for encouraging me to carry out the study and by providing invaluable guidance, constructive suggestions, instructions, inspiration, support, regular feedback and cooperation throughout this study.

Similarly, my sincere thanks goes to associate Prof. Dr. Bal Chandra Luitel, PhD for providing such kind concept of thesis which is related to day to day life and encouraging me during my research.

I would like to express my deep gratitude to Tanka Nath Sharma, PhD, Dean of the School of Education, Kathmandu University for his valuable facilitation and support for my project. This study would not have been possible without his support.

I would also like to express my sincere gratitude to Ass. Prof. Tika Ram Pokhrel, Sahadev Uprete, Binod Prasad Panta, Pundary Phuyal, Amrit Poudel, Toya Nath Sharma, Sheskant Pangeni, Dil Bahadur Gurung, Nilam Shrestha for their facilitation and inspiration throughout my new dimension of learning journey about mathematics education in Kathmandu University.

I express my sincere thanks to all my classmates (2011 Feb. batch M.Ed. students), namely Buddhi Ratna Maharjan, Bimlesh Mishra, Dilip Kumar Acharya, Hari Bista, Ketana Thapa, Niroj Dahal, Pratima Sapkota, Ramita Dong, Satya Raj Joshi, Santosh Poudel, Subash Karki, Surendra Singh Thaguna and Surendra Mishra who always shared their valuable ideas, knowledge, suggestions, advice and inspiration in our learning journey at Kathmandu University.

I express my sincere gratitude to the principal of Shree Harisiddhi Higher Secondary School, Harisiddhi, Lalitpur and my staff teacher Mr. Rudra Mani Bhattarai (English teacher), for encouraging and helping me during this study.

I would like to express my gratefulness to all my family members especially to my mother Mrs. Dash Maya, my loving son Devin, and brothers Mr. Shyam Kumar and Mr. Dinesh for their regular encouragement, cooperation and moral support while I was busy with this study. Similarly, I would like to express my heartfelt gratitude to my wife Yamuna Maharjan who always supported and inspired me to move ahead in this effort. Without her support, help, conviction, and patience this study may not have been possible.

I am thankful to Mr. Raju Maharjan, Mr. Dil Bahadur Shrestha, and Mr. Ganesh Khatiwada, administrative staff of Kathmandu University, for their support with my study, and librarians for providing me with required books and research materials available at KU library.

Lastly, I would like to thank to all known and unknown well-wishers, friends and colleagues who have contributed and supported my research directly or indirectly.

ACRONYMS

A.M	Anti Meridian
A.D	After Date
B.A	Bachelor of Arts
E.C.C	Educational Coordination Center
H.C.F	Highest Common Factor
I.C.T	Information and Communication Technology
K.U	Kathmandu University
L.C.M	Lowest Common Multiple
M.Ed.	Master of Education
M.P	Mark Price
P.M	Post Meridiem
PhD	Doctor of Philosophy
S.L.C	School Leaving Certificate
S.P	Selling Price
S.E.D.U	Secondary Education Development Unit
T.T	Table Tennis
T.V	Television
V.D.C	Village Development Committee
V.A.T	Value Added Tax
Z.P.D	Zone of Proximal Development

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CHAPTER I

INTRODUCTION

Chapter overview

In this chapter, I portray my research questions. All the research questions are based on my life experience as a mathematics learner and a novice teacher in different environments. I try to elaborate the difficulties of teaching and learning mathematics from primary level to master's level as a novice teacher and a novice researcher.

I have generated different episodes related to my life, based on my research problems and presented it logically. The main theme of my study is incorporation of local mathematics with pure mathematics. For clear understanding of this chapter, I have also discussed the problem statement, significance of the study and limitations.

How did I set the scene?

In the beginning of my study, I only studied what the teachers taught, the content that was there in the text books. However, I also did and not get satisfied with the teaching methods and wanted a change in learning and teaching process. I started looking for universities that would make me a transformative teacher. I visited K.U. thinking of myself as only a student and a teacher who is trying to bring change in teaching profession, I went through lots of teaching methods and theories. After completing my 2nd semester, I participated in Research class for Master's dissertation. In the beginning, I thought the class was not new for me because I had done lots of research such as action research, case studies, trainings, seminars and other programs. But I was frightened about the thesis as I felt it would be difficult. It was vastly different from the case studies and action researches that I had previously completed.

According to my professor who facilitated research methodology in 3rd semester, all the participants had to bring in at least three issues on mathematics learning and teaching for research which was a very difficult task. At last, I was able to think of three issues as the role of mathematics teacher to relate our daily life mathematics and school mathematics in teaching and learning, the importance of educational materials in mathematics teaching and causes of high failure in mathematics. According to our research facilitator, the first one was the best one for my research. So, I selected the first one. One mathematics teacher who has always inspired me said that it might be too vague a topic for me. According to him, I had to take a small issue for my research but my whole mind and body was eager to study what my professor had suggested. Sitting on the bases of my topic, I started writing the chapters.

In the 4th semester, we were very lucky that we got to take the class of dissertation ship again. All the professors wanted the students to able to complete the thesis in time. So, the management had decided to introduce the class. I would like to thank all the professors and management committee for supporting the students. During that semester, I prepared a list of my past experiences and forwarded it to my professor (Research facilitator). By reading my stories/episodes, he was very happy with me and encouraged me to generate other episodes using beautiful sentences. He also forwarded my episodes to some other facilitators in the college. While taking the class of seminar issue in 4th semester, Phuyal sir had discussed about my episodes and suggested to change the title. He suggested that I should name my research, "Teaching mathematics through everyday life materials in the secondary level." He gave me many ideas to write about my study. In his view, I had to show the pictures related to our daily life. This way, I started to write about the thesis.

While writing my thesis, I got good suggestions from my supervisor. One day, I got a chance to visit him at Ratobangla School which is a popular private school of Lalitpur, district. Showing my chapters, I said that I had completed six chapters and needed some suggestions. My supervisor politely gave me suggestions and listened to my views towards my research. After a long time, he suggested to construct more attractive title and research questions. He wanted my research title to be" My experience of incorporating local knowledge with school mathematics." In this way, I set my research title according to my views and I am very grateful to all professors who gave me good inspiration to write about this paper.

Personal and professional context

A person who teaches to the students is known as a teacher. If he/she has a well planned lesson before going to his/her class, the students will learn. In the context of Nepal, most teachers enter the classroom and teach the contents in the text book which is a traditional approach; teacher centered. Most teachers seem to focus on rote-learning and are exam oriented. I am also a teacher. I have been teaching in lower secondary level for the last 14 years and the secondary level for the last12 years, mostly in government school in Lalitpur district. When I started, I also followed the traditional approach because my teachers used it. They came to school and focused only on reading, solved the problems of text book only. In general, the traditional approach to learning is focused on mastery of content, with less emphasis on the development of skills and nurturing of inquiring attitudes. The present system of education is teacher centered, with the teacher focused on giving out information about what is known. The teacher is the dispenser and students are the receivers of information. The traditional teaching approach is more concerned with preparation for next grade. When the students' responses that I was only focused on the talent

students, I noticed that I was doing what my teachers did. While solving the problems of text book, some students felt that they were nothing to learn and the result was not satisfied. This made me to notice, “Was I following out the traditional method?”

As a teacher, I focused only on course books and gave all the time solving the problems of books and reference book (question bank) in the beginning of my teaching. Sometimes, I asked for a feedback about my teaching style. Most of my weak students said that I only supported the talented students in the classroom, and didn’t take care of weaker students. Reading their feedback, I believed that I was doing what I knew and what my teachers did. At that time I remembered my learning process such as rote learning, teacher centered, and text book centered which was traditional approach. I remember during a parents meeting for grade 10; one of the parents raised the question, “why did the students fail their mathematics first term examination even though there were additional classes for the students?” The parent who raised this question was absolutely right and focused on my teaching method. At that time, I remembered my school. One of my friends, named Rajendra who was poor in mathematics, argued that mathematics teacher only taught to talented students, did not care for weak students, and also followed only text book. This raised some questions in my mind, “Was my teaching method wrong? Was my teaching approach not according to the interest of all the students? Was I still following the teacher centered not students centered method? ” These kinds of questions were raised for me and were running on my mind. I had participated different seminars, workshops and training and got knowledge about how to teach the students effectively. There are different teaching method such as project based, problem solving, interaction, deduction, induction, field work etc. which will be useful and necessary in teaching and learning process. So, I wanted to change the teaching style but it was difficult for

me because when I was a student, I had experienced rote learning and thinking that the teacher was great.

As a student of mathematics, I remembered my past and found out that there were lots of problems in teaching and learning process. In the beginning of my learning journey, it's difficult to understand the mathematics and I believed that mathematics learning is only calculation and nothing more. Similarly, as a novice teacher, it is also difficult to facilitate the students with new concepts. It is easier to follow how I was trained. All the teachers may be similar to me as a result; it is hard to fulfill the requirement of the world. We, human beings are looking for their fulfillment in life. For this, the change is necessary. According to the needs and interests of students, the teaching and learning process should be changed. The students should actively participate. We the teachers have a role as a mediator. "*No matter how patiently I explain things to my students and no matter how often I repeat the explanations, I cannot learn for them."* This is the kind of quotation which describes how students are not empty vessels, and they need to learn constructively and actively in order to fully connect and grasp the content being discussed. The duty of a teacher is to explain and dictate to his/her students' abstract facts about a subject matter; however, that is not how a student truly learns.

As a university student, it is not good to follow the traditional approach. It will be my fault if I follow what I know. I am not satisfied with my past methods of teaching and learning. As a transformative teacher, I want to change my teaching and learning methods and slowly I am trying to change my teaching style by incorporating local knowledge or materials with school mathematics. I hope that my performance will increase and I will be more satisfied with my study. We know that the past is only experience, the present is what we are implementing and the future is the result. The

study of past or looking back to our life is the study of our own personal skills, knowledge and will help to change the present, allow and push me to think about the teaching approach. The use of glocal knowledge in classroom makes the students very active and empowering in learning. So, I choose the Incorporation of glocal knowledge as pedagogical approach in teaching learning process.

Actually I am from a middle class family. My parents are illiterate. They did not get any opportunity to take formal education as well as non formal education. My father was a carpenter and a farmer. He always used to say to me, "You are studying mathematics. Can you tell me the mathematics of a carpenter? What should be the total cube of wood to make door, window, and desk- benches? How can you cut it to make different shapes?" Furthermore, he asked me about the requirement of workers to dig a ropanee[1] of field, area of field, estimation of planting etc. likewise, my mum , who also did not have any formal education , knows the mathematics behind cooking rice, making delicious food of different shapes of geometrical as chatamari[2] (circle shaped) , yomari[3] (cone shaped) etc. When counting money, she counts ten coins of a rupee as ten rupees. She uses many mathematical shapes while working in the kitchen, on a field and so on. In this way, my parents are unknowingly using mathematics in their life. At that time, I felt that mathematics is not only a subject that gets taught by teachers in school but also as a foreign subject. Also, by observing the activities of my parents, mathematics is everywhere and already there in the world.

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[1] A ropanee in Nepal (Nepali:रोपनी)(in hilly regions)1 Bigha=13.31 Ropani, 1 Ropanee =16 aana(आना)(about 508.72m^2 5476 ft^2.1 aana=4 paisa(पैसा)(about 31.80 m^2 or 342.25 ft^2.and 1 paisa =4 daam(दाम)(about 7.95 m^2

[2] A delicious bread using the rice in newari culture especially on the occasion of dewali in newar of Harisiddhi village/ shreepanchami day(saraswati puja)

[3] A delicious food made by using rice flour in which postakari (chaku in newari say) is kept inside the yomari. It is made only in yomari purnima.

In the beginning of school, I was impressed with the study of mathematics because it is related to our daily life. Teachers taught counting numbers using sticks (one stick, two stick…) as well as using stones. This made mathematics seem like fun and games. At that time, I went to coaching class in the morning and evening where teachers only taught us mathematics. They guided us very effectively to learn mathematics. While studying at grade 2, one day my teacher told me to recite the multiples of 2 through to10. At that time, I failed to answer it and then she scolded me as well as hit me with a stick, which I can never forget. This made me see mathematics as a punishment subject. The punishment is against law. Individuals who engage in costly punishment do not benefit from their behavior, according to a new study published in the journal Nature by researchers at Harvard University and the Stockholm School of Economics (source from Google). So, it should not be used in mathematics teaching either. The authority of the students is learning the mathematics. If he/she fails to do the activities in math, he/she should be well and meaningfully taught by the teacher. The duty of the teacher is to teach the students not give them punishment. In this way, we the students only followed rote learning.

While studying in the lower secondary level, I had opportunity to learn mathematics by our great head teacher. His teaching method was very interesting but he was very slow and busy with his own work. At that time, I felt that mathematics was an interesting subject. At grade 8, one volunteer teacher came to teach us optional mathematics. He taught us very nicely and friendly. I understood clearly and scored 100 marks in all exams. For that reason, I won't forget him. He showed us how to derive formulae for trigonometry in such a way that it seems easy. This made me think that mathematics was invented not discovered. Because of this easiness with mathematics, I loved it very much and thought of it as my girlfriend.

In the secondary level, I had opportunity to learn mathematics with another math teacher. On the first day, I felt that he was going to be a great teacher to us but turned out to be the opposite. He looked like a 'bearded' political leader. All of the students were afraid of him. When my friends asked him questions, he seemed very angry and scolded very badly. He didn't complete our course in grade 10. Thinking mathematics as incomplete subject, we went to take coaching class and studied mathematics very well there instead. In this coaching class, our mathematics tutor taught us Ptolemy's theorem by making it very interesting with reason while in our class, our teacher told us that the theorem should be memorized, and there was no reason. This made me think that mathematics as memorization subject. Likewise, the behavior of our mathematics teacher made me think of this subject as horror, ghost. While studying in grade 9 and 10, there were lots of formulae and symbols to remember. In this point of view, mathematics is collection of formulae as well as symbols. Moreover, I got the highest marks in mathematics in S.L.C. level and that made me very happy and wonderful. At that time, I felt like it was a beautiful and wonderful subject.

From pre-primary to S.L.C. level, I learnt lots of mathematics and knew the nature of mathematics. In this subject, we are always faced with solving a problem. So, it can be say as also be said that it is problem solving. While solving problem, we have to think and use logic. After S.L.C., I joined college to further read about mathematics. I didn't get a good teacher and I did not get sufficient time to study. Actually, I had no time to study at the time as I had to look after and provide for my family. I had to work so my only mathematics was the calculation of total salary in a month and divide expenditures in between home and education for my brothers as well as myself.

Similarly, in Bachelor's level, it was very difficult to learn mathematics because of self learning and I didn't have time to practice. Most of the mathematics I had exposure to be theorems and proof that were very long. To secure good marks, the solution had to be as per the text book. At that time, I thought that mathematics is only rote learning and not applicable, I felt it was mostly theory without enough calculations. In the exam, most of the students passed by cheating and copying which made me think that mathematics is plagiarism. Likewise, I joined master level in one of the University of Nepal to learn mathematics but I couldn't find the meaning of math and asked myself," What are the application of mathematics?" Is it only for being teacher and professor? Is it only the collection of unnecessary theorems which are not related to our daily life? These questions made me very frustrated about mathematics and thought mathematics was a lifeless subject and had no applications. I found Kathmandu University to study mathematics, and thought I would succeed in finding the meaning of mathematics because the teaching process of K.U. is very different to other universities. To complete the degree, I have to prepare a research work by collecting data, related to my lived experiences. There are many issues surrounding mathematics teaching and learning but my topic is to relate our daily life mathematics with school mathematics in the teaching and learning process to make it easier for the students of secondary level to understand.

As per my background mentioned above, I was interested to learn mathematics from the beginning of my study. I only studied mathematics from the textbook and our teacher did not connect mathematics with our everyday life. Although, we cannot imagine our life without mathematics, it is taught in a way that is not related to our lives. I faced many problems when learning mathematics. The teachers entered the class, opened the book and solved one or two problems and said that it should be

memorized. I thought solving the problems was not studying mathematics itself. I found mathematics in my home such as plate, Chalani, Nanglo[4],chatamari etc (circled shaped), drum, gas cylinder, chimney etc (cylindrical shaped), rectangular room, wall, carpet, triangular prism as roof of house, pyramid shaped roof, profit and loss of family and so on. Similarly, cooking rice at home, working on the field and as well as a carpenter, I found that there was maximum use of mathematics. I questioned myself that where did mathematics go? Why did I not get such kind of mathematics in my learning class? In this way, there are many questions raised while I am teaching and learning of mathematics. As a novice teacher and transformative teacher, it should be solved by relating the local context.

Selecting the research topic

The difficulties of students are lack of problem solving techniques, many incompressible formulae, excessive calculation, non experimental nature of mathematics, lack of interest, poor teaching, tear of teacher and subject. Students have the notion that mathematics is difficult, the attitude that the mathematics is only for the gifted, and a general fear of the subject. The huge number of students of secondary level feels that mathematics is very hard subject and like ghost. Most students fail to meet minimal mathematics proficiency standards by the end of their formal schooling (U.S. Department of Education, 2003).On the basis of these argument, we can conclude that in examination, most of the students are failure in mathematics. According to Luitel and Taylor (2009) mathematics is taken as pure and infallible body of knowledge. Rules are fixed principle are already determined which

[4]Chalani/ Nanglo are a popular artifact in every rural Nepali house, used for the purpose of winnowing the rice and other grains.

are unchangeable so mathematics is taken as series of fixed rules and algorithms. According to Exam controller Khaga Raj Baral, many students fail in mathematics in S.L.C (Published at Republica, 2013) and the parents feel that it is because of their teachers. However, some mathematics teachers work hard to teach their students. I find that the mathematics teachers are more devoted to teach their students than other teachers. Some give more time to teach their students. Sadly, the result is not favorable to mathematics teachers. Furthermore, many students go to take extra tuition classes in this subject. The parents also feel that if their sons/daughters don't take extra tuition, they will fail the examination. It seems that students and parents are always in worried about mathematics. It seems that students give more time to mathematics in the classroom as well as at home but they still do not get the desired results, why is this?

In my view, one of the reasons may be the traditional teaching approach and evaluating process that is currently used. To improve the teaching and to increase number of students that pass, we should change our teaching approach. We have to relate our day to day life mathematics in school mathematics. I agree with Luitel about the mathematics who mentions, due to the lack of inclusion of local knowledge in mathematics, mathematics is considered by students and teachers as a foreign subject. That means mathematics should be learned with connecting day to day life. Moreover, all of the different appliances that we have in our homes have been created by mathematics such as computers, T.Vs, music players, washing machine, fridge, and all use math as their basis. Likewise, lighting and heater are calculated by mathematics and so are the bills that we get too regularly. It has to be worked out how much energy we have used and has to be multiplied by how much each unit costs. Also we have to calculate the taxes. Any taxes also have to add onto the final bill.

When we pay the bill, we may use a variety of methods as using cash, credit or bank transfer. We need math to complete this. Likewise, while decorating our home, or laying new flooring or carpet, we need basic mathematics for the measurements so that we know exactly how much materials are required. Furthermore, cooking needs mathematics so that we will use the right amount of each particular ingredient. Even things like working out sell by dates and best before dates on the different foods that we eat uses mathematics. In this way, mathematics is used in every step of life. So it should be related in school mathematics.

Statement of the problem

We know that mathematics is very important in our daily life. It is used in every step of our life. Without it our life is impossible. But many students are not interested to learn this subject. So most teachers and students believe that mathematics is very hard to learn and teach. As a result, a large number of students fail in mathematics and every guardian feels that this is because of low qualification of teachers. The teachers did not teach well. So the students are failing in this subject. In my opinion as well as according to my practices, mathematics teacher spends lots of time teaching mathematics compared to other subjects in SLC exam. Then why is the mathematics teachers faced with these issues? Are mathematics teachers actually the main cause of failure in mathematics exams? Are we all following the traditional methods of teaching and learning process in the mathematics classroom? So that large number of students fails in their mathematics exam. Do the teachers teach to the students what they have learned and the contents in the book? I mean, do the teachers only focus on the books? Are there lacks of incorporation local context with everyday life materials or local mathematics with school mathematics? Dothe students feel that math is only a calculation subject? These all questions pushed me towards thinking

about local knowledge in mathematics. Can we solve all problems by relating local context in teaching learning of mathematics? In my experience, the students are very back from the knowledge of mathematics of everyday life. They only know about how can secure high marks in mathematics, but they don't know about the use of the mathematics in life. So my issue is to know the relation between local knowledge and schooling knowledge. Nowadays, schooling has been considered both a cause of loss of glocal knowledge (because it opens pathways to the non-local world and worldviews) and a potential remedy to its demise (if educational curricula is aligned with indigenous realities by giving instruction in local languages and incorporating local knowledge in school content. Moreover, I want to try my best to teach mathematics effectively by incorporating glocal math with school math.

Research questions

This part of my study elaborates the information of implementation in the title of the study. So it is very important for study. In my paper, I want to intend to address the solutions of the following questions:

1. How did my experience change in my perception about learning /teaching mathematics as a "pure math" to "glocalised" subject?
2. What changes in learning experiences do students express towards the use of glocal math "knowledge "and artifacts?
3. How does incorporation of glocal knowledge empower learners?
4. What are the challenges I experienced in incorporating glocal knowledge with formal school mathematics?

Significance of the study

The significance of this study is for the students as well as the teachers. It helps to identify the factors which influence the students who do not enjoy

mathematics very much. Also, it helps to relate daily life mathematics with school mathematics for clear understanding. I will also be able to understand the role of relating the everyday materials while teaching mathematics in the classroom. While walking on the road, eating food, doing anything else, I believe that I am using mathematics. At the same time, the students will also feel that they can learn mathematics very easily. I would be able to say that the use of every day materials in the classroom is the key study of my thesis or incorporating local knowledge /materials with school mathematics is main study of my thesis. I think that this will help me to understand the role of the mathematics in my life and also have lots of knowledge and its significance in relation to the mathematics what I have experienced as a student as well as a teacher. Moreover, the mathematics learners will be able to understand about the relation between the school mathematics and day to day mathematics. I claim, they will relate everyday materials in mathematics teaching so that the students will know the actual meaning of mathematics and they will feel that mathematics is not so hard.

Limitation and Delimitation of the study

This study focuses on incorporation of glocal knowledge with school mathematics for secondary level students. That means teaching mathematics through incorporation of glocal mathematics with school mathematics can be used for easy understanding to the students. As a researcher, I understand that I will be bounded by lots of ways while going on the study. As I've mentioned previously, I will focus on the relationship between school mathematics and daily life mathematics. For this I will share my own experiences, values and standing as a student, a teacher, or a person. Also, the study will be carried on the inhabitant of Shree Harisiddhi Higher Secondary School of Harisiddhi Development committee, Lalitpur district. During the

time I conduct this study, the participants of my study will be able to interact with me and other resources will be used in my study. There will be multiple methods of textual presentation in my study such as narrative writing, reflective journal /dialogue, story writing/ poems /dreams related to my life experiences. To verify the points I have made in my experience I will be reviewing some literatures. My literature review may not find suitable rooms to befit in Nepalese context as most of the reviewed literatures were of western cultures. There will be interpretive and criticism paradigm mostly. The paradigm of interpretive explores my own beliefs as well as the participants' beliefs. Similarly, I will apply materialization as the trait of my inquiry and there will be lots of stories, poems related to my lived experience, presented in my study during my time as a student, teacher, trainer and researcher and critically analyze them.

Chapter summary

In this chapter, I have explored my educational life history as a child, a student, a teacher and a researcher thereby outlining the research issues and related research questions. I have generated different chapters as chapter IV, chapter V, chapter VI and chapter VII to address my four different research questions which are listed with different views. Each and every episode has its own story. First research question is based on me as a learner from primary level to master's level about learning mathematics as a formal mathematics learner, and as a teacher of mathematics. The second research question is based on how the students felt the change of the mathematics after using everyday life materials or glocal knowledge in learning materials. My third research question expresses the empowerment of mathematics as well as incorporation of how the glocal knowledge empowers the learners and final research question is picked out from curriculum agenda, teaching

method which expresses the challenges of incorporating glocal knowledge in school mathematics.

CHAPTER II

LITERATURE REVIEW

Overview of the Chapter

In this chapter, a review of published literature which is related to various aspects of problem in this study is presented. It is one of the essential aspects for my study. Cooper (1998, as cited in Creswell, 2003, p.210) suggests that literature review relates a study to the larger ongoing dialogue in the literature about a topic, filling in gaps and extending prior studies. Similarly, it explores the published information in a certain area which provides us more information to our particular study. So, in this chapter, I deal with many literatures which are relevant to my research. I have presented three level of literature review. They are the thematic review, the theoretical review and the previous research related to my research. For this, I have collected many literatures and explored those according to my understanding which support on incorporation of local knowledge in pure mathematics. First of all, I have shared about the essence of terminologies which I include in my research. Without the meaning of terminologies, it is difficult to understand. To understand any research, we have to know the situation and contexts where it is located. So, I hope that the meaning of terminologies help the readers to understand my study.

Incorporation

According to the free dictionary.com, incorporation is consolidating two or more things, union in (or into) one body. Similarly, it is learning of values or attitudes that are incorporated within us. Furthermore, it is an act of including. In my study, I use this word for incorporating the local knowledge or local materials with school

mathematics. I want to study what will be result after including local knowledge in pure mathematics.

Local knowledge or materials

Local knowledge is the knowledge that people in a given community have developed over time, and continues to develop. It is based on experience, adapted to the local culture and environment, often tested over centuries of use, embedded in community practices, institutions, relationships and rituals, held by individuals or communities and dynamic and changing. Similarly, it is a collection of facts and relates to the entire system of concepts, beliefs, and perceptions that people hold about the world around them. It includes the way people observe and measure their surroundings, how they solve problems and validate new information .It includes the process whereby knowledge is generated, stored, applied and transmitted (Warburton and Martin, 1999). So, in my research, I will try to show local knowledge

> Knowledge systems are dynamic, people adapt to changes in their environment and absorb and assimilate ideas from a variety of sources. However, knowledge and access to knowledge are not spread evenly throughout a community or between communities. People may have different objectives, interests, perceptions, beliefs and access to information and resources. Knowledge is generated and transmitted through interactions within specific social and agro-ecological contexts…
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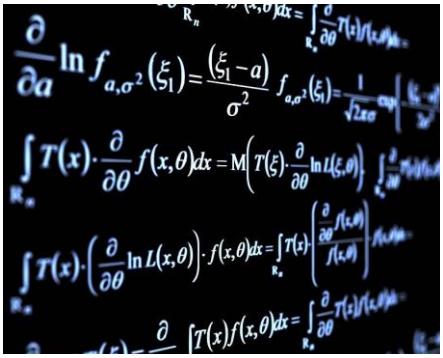
> Sources: FAO CORPORATE DOCUMENT RESPOSITORY

or local materials while teaching mathematics in the classroom. Most of the episodes in this study are based on glocal knowledge.

Pure mathematics



Broadly speaking, pure mathematics is mathematics that studies entirely abstract concepts. From the eighteenth century onwards, this was a recognized category of mathematics activity, sometimes characterized as speculative mathematics, and at variance with the trend towards meeting the needs of navigation, astronomy, physics, economics, engineering and so on.(Source: Wikipedia.org, 23 Sep, 2013). By this view, we can say that the mathematics which is taught to the students nowadays at classroom is a kind of pure mathematics. It is very abstract and that's absolutely why most students are afraid of this subject. There may be different ways to solve the problem. Many researchers have studied about this issue. According to Luitel & Taylor (2012,p.35), one of the moral bases for promoting contingent, connected and contextual truths in my teaching is that such truths allow students to think creatively and constructively rather than embrace an exclusively dogmatic view of mathematics as a pure, indubitable and certain knowledge system. By this, we can say that the students can understand mathematics by creatively and constructively if the contingent and contextual truths are highly promoted rather than pure mathematics. Furthermore, they argue that it might be through this feature of narrative logic that an inclusive view of mathematical knowledge and knowing makes a significant impact in the field of mathematics education by helping students see contingent but useful forms of mathematics interacting in their life worlds. It focuses

on the feature of narrative logic which has universal value. It could help reconceptualise my pedagogy via the lens of cultural imagination (Baldwin, 2006 as cited by Luitel & Taylor, 2013). The cultural imagination might be based on local narratives which explore diverse pedagogical pathways. So, it might be better to incorporate local knowledge in school mathematics.

Developing a standpoint

We know human beings are creative and a social animal. So, mathematics is necessary for human beings. We cannot imagine our life without mathematics. Human life without mathematics means a human without creativity and a society without human creativity would mean a frozen world. In fact, mathematics is upgrading together with the development of human civilization. In the beginning of human beings, it is most important and used in daily life situation. For socialization of human beings, it is developed. If they did not imagine and think about mathematics, their socialization is impossible. To make "we" from "I", mathematics is developed to say 1, 2, 3… so, mathematics is very important to stay in society. The first counting method was one to one correspondence, object to finger, sticks and pebbles (Eves, 1983, p.2, as cited in Poudel, 2008, p.1). This represents that the development of the mathematics from symbolic to vocal. Being a mathematics student; I like mathematics very much because it is very interesting and practical subject. I was a school student; I always cook rice to help my mum. At that time, I used mathematics in cooking. I use a girnderstone which is shape of cuboids and cylinder. To make bread, I use cubical form of wood and cylindrical shaped bamboo. Lots of material in my life is related to my school mathematics. It is very meaningful for me to have the knowledge of day to day life materials. In this way, it is used in every step of our daily life and it helps me to learn mathematics well. Without it, nobody can succeed. When I was a secondary

level student, I liked it very much and I did all exercises of it. At that time, I was the hero of the class. I felt like I was a great mathematics student. I obtained high marks in every exam. After entering college for higher education, I found it very difficult to learn mathematics. It was because there was no sufficient time for practice and teaching method was different from school. According to Luitel (2009),"a great deal of my learning experiences of undergraduate mathematics entailed the image of mathematics as a meaningless subject." At that time, I also felt like mathematics was a meaningless subject. There was no interaction between students, no practical sessions when studying in school and at a college level. I could not find the use of mathematics in daily mathematics. The teacher comes to class room and asks the students to copy the theorems from the board. When I joined in K.U. for M. Ed, I was really impressed with their teaching approach. In the beginning, I found it a little bit difficult to learn in K.U. because the teaching medium was English which was new for me. I went to government school where all classes are in Nepali medium except compulsory English. Slowly I was able to learn English and all my professors gave me good support to learn. I found that educational environment of K.U. is totally different. Every subject is taught in practically, constructively, actively by the facilitators. So, nowadays I am again finding it very interesting and getting an opportunity to learn mathematics. After my first and second semester, I believed that mathematics was not so hard to learn and teach. It is the creation of ideas with interaction of environment. Teachers are only facilitators because all knowledge and skills are constructed by interaction of students.

In my learning journey, mathematics plays a vital role. There are different types of nature of mathematics in my life. From my experience, although mathematics is an interesting subject as well as wonderful, most of students feel that

mathematics learning is a bore. Similarly, it is a logical subject and the students who can use his/her mind logically while doing mathematics can solve the problems. Also, the students who can remember or memorize the rules of mathematics can do the mathematics easily. But there are different kinds of students in class. Low achiever students are always afraid of teachers who teach mathematics and struggle in class. It is a hard subject for weak students and even parents also cannot solve the problems of mathematics. The students always have to face different kinds of punishment while learning mathematics and are always afraid of teachers. In this concept, we can say that it is a nightmare for weaker students whereas interesting, wonderful, logic, problem solving, world, and memorization for talented students. Moreover, rote learning is focused on mathematics and students get more punishment in mathematics than any other subjects. On the basis of this concept, we can say that mathematics is a kind of rote learning as well as a punishment subject. By hook by crook, we need it very much in daily life and we have to know about mathematics. Lerman (2000) focuses on only what mathematics really all, but not the way of teaching and furthermore he says that mathematics is social construction of knowledge. I accept his argument because without social construction, it is impossible to think about mathematics. According to Luitel (2009), my education pedagogy will now be or influenced by the nature of mathematics as im/pure body of knowledge this is because ,in one sense , is not easy to change myself radically and our existing circumferences as well. It will be my first attempt to introduce new pedagogy on the basis as mathematics as body of im/pure knowledge. In other sense as Luitel (2009), I do not believe myself that mathematics as a pure body of knowledge is completely replaced by the body of impure knowledge, this is because of our national education plan, curriculum, course of study, our traditional teaching learning activities etc. so,

energy of both of the aspects described by Luitel would be realistic way in the development of mathematics enjoyable, entertaining, meaningful and applicable.

When I started to learn mathematics, my perception about learning mathematics was only drilling problems from text book following and remembering fixed formulas, definitions, symbols, completing exercises and preparing for examination. During school level as well as college level, I understood mathematics as foreign (Luitel, 2003) because there were not any related examples from our context. I found that there consisted of already discovered rules and procedures which were to be applied to do particular problems. I perceived mathematics as difficult subject, and only inborn talented students can learn it. Teachers and text book are the main sources of knowledge. In my experience, many of the teachers have followed behaviorist approach (Belbase, 2006, as cited in Dahal, 2013) of teaching, where teacher's role was superior in the classroom. So, teaching and learning mathematics in the classroom is different from our society and daily life situation. We know that Mathematics is necessary for a person in order to live as a useful and effective member of society because we believe that logical thinking is included in mathematics. A farmer requires knowledge of arithmetic to work out how much fertilizer to buy for his farm produce. Similarly, a builder requires knowledge of shapes and solids, of measurement, to design and build a house. In this way, we all need knowledge of ordinary process of arithmetic when we want to buy, eat, or do any other activities. Perhaps, this knowledge (glocal knowledge) helps in teaching mathematics. Also, Luitel (2009) mentions that mathematics lives in various day to day works, embedded and embodied in the society as cultural practices. Similarly, some scholars have developed a theory of culturally relevant pedagogy that examines the teaching –learning process within a critical paradigm and through explicit

connections between students' culture and the school subject matter (Rosa & Orey, 2003). Referring to this, I want to follow the way in which to contextualize mathematics concepts according to our cultural practices. According to Torres-Velasquez and Lobo (2004), this perspective is an essential component of culturally relevant education because it proposes that teachers contextualize mathematics learning by relating mathematical content to students' culture and real–life experiences. Also, the guidelines of the National Council of teacher of Mathematics (NCTM, 1991) highlight the importance of building connections between mathematics and students' personal lives and cultures.

Nature of mathematics and learning

According to Reuben Hersh (2003)"Mathematics is a science like physics or astronomy; it constitutes a body of established facts, achieved by a reliable method, verified by practice, and agreed on by a consensus of qualified experts. But its subjects matter is not visible, not empirical. Its subject matter is ideas, concepts which exist only in the shared consciousness of human beings. So, it is both science and humanity. In this point of view, we can say that mathematics is not visible which used day to day life of human beings is. Since its subject matter is ideas, concepts, it should be introduced in the class room. The feature of symbolic, abstract, algorithmic, and formal mathematics is the view of mathematics as culture – free subject which also can be a politically motivated expression for not incorporating knowledge system arising from people's practices (Luitel & Taylor, 2007).There are lots of students from different cultures. They share their knowledge with each other so that they will get knowledge of mathematics of everyday life of each person in the classroom. In mathematics class, we can see many critical questions related to mathematics learning. For example: In what ways does learning mathematics affect on the

students? What kind of power such as relationship between mathematics with home and society is developed by students? How does the student change their behavior after learning mathematics? These all questions are challenging to all mathematics teacher, educators as well as students. For this, we need to understand mathematics and it s social relations and value.

According to Hersh(1979,p.33,as cited by Lerman, 1990) "The issue then, is not, what is the best way to teach , but what is mathematics really all about … controversies about high school teaching cannot be resolved without confronting problems about the nature of mathematics . Actually, he describes mathematics is a subject which is observed by all of the people and particular used in mathematics as the paradigm of knowledge, certain, absolute, value-free and abstract-with its connections to the real world. The history of mathematics is irrelevant to the nature and justification of mathematics knowledge, it is pure isolated knowledge which happens to be useful because of its universal validity, it is value free and culture free, for the same reason (Ernest, 2001, as cited in Sharma, 2012). But fallibilism rejects the absolutist image of mathematics as body of pure and perfect abstract knowledge which exists in a superhuman, objective realm (Sharma, 2012). In fallibilism view, mathematics is social construction of knowledge. Insisting on the variability of experiences of cognitive agents from which knowledge is constructed, Lave (1990, p.19) argues that the mathematical learning can be understood through a network of relations between people and social settings as well as cultural settings. Here, the conceptual knowledge of mathematics, cultural activities and social relations are interdependent. So while teaching mathematics to the students, it is better use of the social setting as well as cultural setting. In my view, the use of or relating to the day

to day life mathematics or relating cultural setting in teaching math will automatically make the students learn about the importance of mathematics.

Also it is defined as the science of numbers and space. So it is very wide. According to Luitel (2009), the education pedagogy will be influenced by the nature of mathematics as im/pure body of knowledge because it is not easy to change myself radically. Introducing a new pedagogy on mathematics is a body of im/pure knowledge. Before understanding the concepts of Luitel, I did not believe myself that mathematics as a pure body of knowledge which would be completely replaced by the body of impure knowledge. I had not known impure local knowledge should be incorporated in teaching learning process to get the good concept of pure knowledge. Introducing the local knowledge in teaching integrates the meaningful learning of school knowledge. Luitel and Taylor make an argument on the necessity of including the students' life worlds and their cultural assets in an inclusive philosophy of mathematics education. Inclusive philosophy in mathematics discusses multidisciplinary theorizing about mathematics incorporating philosophical, sociological, anthropological semiotic, historical, ethno mathematical etc perspective. Both of them have made an effort to bring up this matter through transformative, critical mathematics and ethno mathematical point of view. They seem to take side of fallibility nature of mathematics giving more emphasis on the day to day practical aspects of teaching and learning process with connection to culturally contextualized mathematics. According to them, such like with culture draws the attention of the interests, abilities and talents of all students. The ethno mathematics also recognizes that all the people do mathematics which emerges through interaction with their cultural and physical environment. Ethno mathematics is very suitable for us because

culture in mathematics awakes the interest for learning school mathematics which introduces new mathematical concepts.

Because of my interest in mathematics, my mind is always open to learning mathematics from different perspectives. I have got lots of my teachers and professors. Out of them, I am very impressed with Luitel and his papers. Most of his papers are related to link between school mathematics with cultural mathematics. Hence, I chose to study about the relation between school mathematics and day to day life. Most students in the class are from different culture and have background of knowledge. In the classroom, they share their culture and learn about different culture in mathematics. Also it encourages the students to explore the mathematics involved in different cultures and their approaches to different mathematical concepts which is meaningful. For example, the materials which are used by newer culture are related to mathematics. The concepts of ethno mathematics encourages students generate interest on reading mathematics deeply.

When I was studying at primary level, one person (guthiyar) named Shiva Ram was very impressed with me because I was able to count the pots of Raj guthi[5] and calculate money for rent charge. He had rented 500 pieces of Bata[6]for his daughter's wedding ceremony. After the wedding ceremony, he came to my home to return these pots. He calculated the rent charge as Rs.1 for four pots. So, he separated the pots as four pieces. I thought it would take long time so, I calculated the rent charge very simply as the product of 500 and 25 paisa (per pots rent charge). Immediately, I said, "its total charge is Rs.125." but he was still counting the pots for charge. At last he also said, "You are right. You calculate very fast. I am very

[5]Raj guthi, in Harisiddhi village, there is large group of local newari people of followed the cultures. The cooking materials for party are given in hire and according to rule; its chare will be taken

[6] A kind of pot made of aluminum

impressed with you." In addition, he gave me Rs.10 for being able to calculate quickly. After a while, he left my home and I thought about his way of calculating. He counted four pots as Rs. 1 and he got 125 times of four pots. So he said that the charge for pots was Rs.125.Although he was uneducated, he was able to calculate by using his local knowledge. I was very impressed with his calculation compared to my calculation which was guided by school knowledge. This kind of calculation impressed me to learn mathematics very actively. In this way, the pedagogy approach of culture based mathematics carries with it the concept of mathematics as a debatable, interactive and non-passive subject. Such approach allows the students to develop a personal role in active learning strategies and in their own assessment procedures. Not only this, they also look for various ways to incorporate the outside-school experiences to in-school or academic mathematics experiences. Consequently, we need to integrate such mathematical activities which are meaningful and have practical use in day to day life. For instance, we can let the students interview their parents and elders in the community about various methods of counting numbers as well as learning or memorization of addition, subtraction, multiplication and division done in different ethnic groups according to their cultures. While teaching geometry in the classroom, we can give some concepts of geometry by introducing cultural artifacts such as Nepali temple, roof of building, yomari (a cone shaped food) in newari culture, rivers, etc.

I still remember those days when a long tour was organized by school. The school administration had decided to have a long tour at Pokhara for grade 9 & 10. I started thinking about how mathematics subject could be used in this long tour. I thought that it was not only used for social studies but also could be used in mathematics. So, I gave to all my students of grade 9 and 10 a mathematics project.

The project work should be done about what they found and saw mathematics on the long tour or use of mathematics. The students had to compare of local materials with their school mathematics. As a result, all the students completed the project work very well.

They found many uses of mathematics as they found different shapes of roofs in Pokhara, distance travelled by them, time period of tour, money they spent, length of rivers, and estimation of height of river and so on. This kind of work made them feel that mathematics is everywhere and they knew the application of mathematics. Also they can feel the use of ethno mathematics in action. By this, we can say that the students perceive the materials in mathematics positively and it empowers them to study mathematics further and there should be a connection with daily mathematics when teaching mathematics in the classroom.

Traditional Paradigm of Teaching and Learning in Mathematics

The traditional approach is explained by the statement of Assistant Professor Dr. Abdullah, Kuzu who asserts that it is based on "traditional view of education, where teachers serve as the source of knowledge while learners serve as passive receivers" (Kuzu 36). By this concept we can say that traditional teacher centered approach of teaching and learning responses that teacher centered approach of teaching and learning where students are quite passive and the teachers are active. The teacher only focuses on the content in the book. They don't relate the content with day to day life. So it is very challenging to relate day to day life mathematics. Likewise, most students will be very bored by the lack of artifacts from their everyday life. They think that mathematics is very hard and it should be memorized. It means the teachers have to face many difficulties when teaching mathematics through artifacts of everyday life. Quinlan (2004) suggests that teachers should begin by allowing

students to explore concrete examples of a concept before presenting its definition, and that the formal terminology and symbolism associated with the concept should be introduced much later, after students have developed a sound grasp of the basic ideas. This is against the traditional paradigm in teaching mathematics. So, we should follow as what Quinlan (2004) suggests.

Teacher's perception on mathematics teaching

A teacher is a person who learns by sharing knowledge with students and reconstructs existing ideas through negotiation. So, a teacher is all for students. But on the way of teaching and learning process, all the teachers follow the method, which was guided. Mathematics is consisting of a collection of facts and skills to be memorized which is learnt by students in teacher method or lecture method. Shapiro (1994, as cited in Dahal, 2011, p.26) expresses that

Constructivism offers a new set of assumptions about learning. It presents the argument that a complete explanation of how learning occurs in the classroom must include a consideration of the experiences of the learner, the key participant in learning. Constructivist teaching approaches focus on learner's views and efforts to consider new ways of thinking about things, for it is the learner who must do the work of integrating ideas into his or her thinking. (p.9)

This view explores that the teachers should be constructivist. They have to change their teaching methods. It is not suitable for students to follow the same method. In the mathematics teaching, constructivism is kept as important and necessary theory because teaching mathematics is a very challenging subject. To be a good teacher in mathematics, teachers should always be updated through participating in different seminars and training.

Similarly, Pokhrel (2010, p.91) has written in his critical thinking practices in mathematics classroom of Nepal towards the teacher's perception as

> Literate –Dream of a mathematics teacher:
>
> I do not have great dream – making him 99 in mathematics in SLC
>
> But I have a dream to make him think critically in every mathematical
>
> Algorithm. I think that my duty is to make my students mathematically
>
> Literate so that they can further do study mathematics or make
>
> Mathematics a part of their daily life.

According to him, the main dream of a teacher is to make students able to assess mathematical tools and apply them in their daily life as well as their future professional or academic life in a proper way. Also, he described that there should be different dream of teaching style in mathematics classroom which enables students to critique the matter as Zhang (2001, as cited in Pokherel,2010,p.92) found a relationship between teaching approaches and thinking styles in teaching. It means that we should have dream about the critically thinking to enable the students. For this, teachers have to think about different new teaching methods which will play a vital role in mathematics teaching. The teaching approaches play an important role in the classroom. It should be related with our thinking styles to integrate about learning to the students. We have to have a good interaction between students in classroom to teach meaningful learning. The knowledge which is mostly related to the students' everyday life should be discussed in classroom so that they can participate actively.

Students' perception on learning mathematics

The most important part of teaching and learning part is students or learners. Neale (1969) expresses that, in the school arena, students with high levels of mastery goals believed that success depended on effort, collaboration, and sense making. We

all know that the mathematics is highly regarded by students. Most of the students think that it is very interesting and take it as a favorite subject. The students show a general interest in mathematics lessons but seldom participate in mathematics extracurricular activities. When they feel difficulties in solving the problem, most of the students will discuss with their classmates, and only a minority will consult their teachers. They hope that others will teach them how to do it rather than copy the solution from others. In my experience, some students think that mathematics is a subject that requires thinking but some students don't want to think while doing mathematics. They want to copy or they want to plagiarize but do not want to learn how the problem is solved. As found in many other studies, hard –working was perceived as the most important factor contributing to success in mathematics, and the most important motive for doing well in mathematics was for getting into a favorite school or getting a desirable job. According to this view, the students have to do work hard for their mathematics learning.

The students would be able to learn meaningfully, if their teachers will teach them according to their need and interest. Thapa (2009, p.78) quotes National curriculum Framework for school Education (CDC, 2005), stresses on the "life skills approach to education." In my view, for meaningful learning, local knowledge motivates the students to continue develop mathematics concept, and prepare them for further study and implementing on their society. The role of incorporation of glocal knowledge with school mathematics is very common and important. The students develop their own idea for example culture, language functions, history, and education from the area of mathematics sources and able to get life skills. I agree with Thapa that it emphasizes on incorporating life skills throughout the subjects rather than adding a different subject. It focuses that there should be life skills approach

subject in education. It plays a vital role in education and changes the students on perception.

Theoretical Referents

I have used some theory as my theoretical referents to make my theoretical standpoint clear. There are many theoretical referents related to my study. With the help of some of theories and literatures, I tried to make clear of my experience in corporation local knowledge with school mathematics for readers. I thought constructivism, postmodernism, ethno mathematics; pragmatism had great influence on my pedagogical practices through my teaching and learning journey.

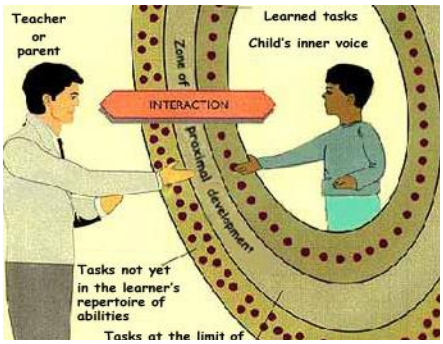
Constructivism in learning:

Social constructivism focuses on the Social constructivist's view of learning as a social process. It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997). Meaningful learning occurs when individuals are engaged in social activities. Knowledge and reality cannot be discovered but it is constructed by human interaction in constructivism, classroom should be wide enough and well-furnished where all desks and benches should be arranged in circular or in movable and compatible form. Teacher should play role of instructor, students are actively participate in collaborative work. Students themselves interact in the classroom; interact with the teacher and their surroundings. Teacher helps or supports the students to find the solution rather than solving the problem him or herself. In constructivist classroom students they try to find the answer of the given problems and learning of one would be the learning of group. In the class students cooperate rather than compete. Hence in constructivism, students are motivated to do their work themselves and teacher work is just to facilitate the students. According to a

constructivist approach, the process of construction is embedded within a social setting and learning is seen as a construction of mental models (Duit&Treagust, 1998). Further, constructivists motivate students to share their own ideas, expand their knowledge through utilizing their experiences, think critically about trying new ideas, and experiences, reflecting upon changing some of their ideas, create meaningful learning environment (Tyler, 2002). As Luitel (2007) has indicated, my attempt is to deconstruct my experiences and their situations in the cultural and educational contexts. This means in my research there may be my experiences in my society.

As far as social constructivism is concerned; it focuses on the Social constructivist's view of learning as a social process. The central elements of social constructivism are the reinterpretation of objectively as social and inter subjective. Its epistemology to be developed from two principles of radical constructivism which are "knowledge is not passively received but actively build by the cognizing subject "and "the functions of cognition is adaptive and serves the organization of the experiential world, not the discovery of ontological reality, Von Glasersfeld (1989, p.182) .Social constructivism emphasizes the importance of culture and context in understanding what occurs in society and constructing knowledge based on this understanding (Derry, 1999).It does not take place only within an individual, nor is it a passive development of behaviors that are shaped by external forces (McMahon, 1997). Meaningful learning occurs when individuals are engaged in social activities. Knowledge and reality cannot be discovered but it is constructed by interaction with each other. In constructivism, classroom should be good environment that means there should be open and wide classroom and well-furnished where all desks and benches should be arranged in "U" shaped or circular or in movable or compatible form. So that group discussion, interaction can be effectively run. Likewise, in this

kind of approach all of the students are encouraged to participate in the classroom discussion as well as other learning activities. The classroom activities should be students centered not teacher centered. Teacher supports the students to solve the problem while they are confusing. In fact, in this approach students try to find the answer of the given problems and learning of one would be the learning of group. In the class students cooperate rather than compete. In this way we can say that constructivism is the way of learning theory where the students are motivated to do their work themselves and teacher work is just to facilitate the students. In this type of teaching approach the students may not be fruitful for them another type of teaching approach may be better. The social world of a learner includes the people that directly affect that person, including teachers, friends, students, administrators, and participants in all forms of activity. This takes into account the social nature of both the local processes in collaborative learning and in the discussion of wider social collaboration in a given subject, such as science. Many of the authors that identify with social constructivism trace their ideas back to Vygostsky (1978), a pioneering theorist in psychology who focused on the roles that society played in the development of an individual. For Vygostsky, cognitive development occurs as a result of social interactions. In social interaction, the students work share with others to make decisions and solve problems. Therefore, their cognitive abilities increase and eventually they gain the ability to function intellectually on their own. One of the key ideas proposed by Vygostsky is called the ZPD which is the range of tasks that are too difficult for a child to master



alone, but that can be learned with guidance and assistance of adults or more –skilled children as illustrated in following figure, children in the ZPD for a particular task can almost, but not quite, performed the task on their own.

Another important idea to be discussed is the concept of scaffolding. It refers to the temporary support that parents,teachers, and more –skilled peers give a child to do a task until the child can do alone. To encouarage collaraborative problem solving such as working in smalll groups to accomplish complex tasks ,Vygotsky theory is very useful. Similary,it helps to teach within the ZPD such as presenting tasks that students can perform successfully only with assistance.

Cobb (1994) examines whether the "mind" is located in the head or in social action, and argues that both perspectives should be used in concert, as they are each as useful as the other. What is seen from one perspective as reasoning of a collection of individuals mutually adapting to each other's actions can be seen in another as the norms and practices of a classroom community.

This dialectic is examined in more detail in a strong paper by Salomon and Perkins (1998), who suggest ways that these "acquisition" and "participation" metaphors of learning interrelate and interact in synergistic ways. They model the social entity as a learner (for example, a football team, a business or a family), compare it with the learning of an individual in a social setting, and identify three main types of relations:

- Individual learning can be less or more socially-mediated learning.
- Individuals can participate in the learning of a collective, sometimes with what is learned distributed throughout the collective more than in the mind of any one individual.

- Individuals and social aspects of learning in both of these senses can interact over time to strengthen one another in a 'reciprocal spiral relationship'.

Reality

Social constructivists believe that reality is constructed through human activity. Members of the society together invent the properties of world. For social constructivist, reality cannot be discovered and does not exist prior to its social invention.

Knowledge

According to social constructivists knowledge is also a human product and is socially and culturally constructed. Each one of us creates meaning through our interactions and with the environment we live in.

Learning

It is viewed as a social process. It does not take place only within an individual nor is it a passive development of behaviors that are shaped by external forces. Meaningful learning occurs when individuals are engaged in social activities.

Role of the mathematics teacher

The teachers provide a leadership or guiding role in teaching and learning. So they are highly influential. For instance, teachers are responsible for the environment and atmosphere that pertains in their classroom. According to Sidhu (1995), there exists no doubt of the role teachers play in what happens in their classroom. Teaching mathematics is a task which, if sincerely undertaken, will challenge the best efforts of the best teacher. Nobody can do a good job of teaching mathematics unless he/ she are willing to make a careful analysis of his /her job to be guided by that analysis. The teacher is main part of teaching learning process. He/she can relate day to day life mathematics in the classroom. Also he/she can create such kind of environment in the

classroom so that the students can easily understand about the school mathematics. Furthermore, the role is essentially a set of expectations imposed on a person by others, in this case it could be parents, society, students or school curriculum (Sidhu, 1995).

Chapter summary

I see many researches and studies which have been conducted on the contextualization mathematics. Although, I have found many researches, I still think that it is not enough to study my curiosity on day to day life mathematics. Likewise, I feel, there is less use of contextualization mathematics in school. I want to contribute towards this in my research. As theoretical referents; I have talked about nature of mathematics, constructivism, and social constructivism. Vygotsky's idea of ZPD is discussed in this chapter. Similarly, I have discussed traditional paradigm of teaching and learning of mathematics. To know the detail of mathematics, I have presented the teachers' and students' perception of mathematics. Moreover, to clear my study, I have discussed about local materials of mathematics, pure mathematics and incorporation of local materials and pure mathematics and to support my ideas, I reviewed some other previous research papers. This chapter portrays only literature review as thematic, theoretical view. So, sitting as literature review, I have discussed mostly about different reviews related to my study and little about my understanding in mathematics teaching and learning.

CHAPETR III

RESEARCH METHODOLOGY

Overview of the Chapter

In the earlier chapter, I have presented my view about learning and teaching mathematics relating with our daily life mathematics. For my support I have linked it with others' research and philosophical considerations in chapter II. In this chapter, I am going to present my research methodology of my research. There are narrative inquiry, personal reflection, and critical reflection etc. Actually, I will elaborate the ways that I am going to study my research. There are philosophical consideration as well as ontological consideration, epistemology and axiology consideration at first and secondly there will be methods used in my research and at last there will be quality standard of my research. These all are important for any researcher.

Philosophical Consideration

In any research the philosophical consideration should be introduced. It gives us the fundamental beliefs to illustrate the problem. Likewise, it provides us as researcher a stand point to design the research methodology. So we can say that it is very important part for good research to know what are the realities, values and knowledge. The choice of research methodology depends upon the philosophical consideration. I am going to study about the relation between the local mathematics and school mathematics .In my study, I want to introduce the philosophical consideration in the terms of ontology, epistemology and axiology. "Philosophical assumptions consist of a stance toward the nature of reality (ontology), how the researcher knows what he or she knows (epistemology), the role of values in research

(axiology)" (Creswell, 2007, p.16), among others. The ontology, epistemology and axiology are the philosophical considerations which are depended upon the different research paradigm that the researcher uses. For example, in the positivist paradigm, we can see only one reality and epistemology will show that knowledge is derived from the natural and scientific study. Likewise, for the interpretive paradigm, we can see multiple realities and the epistemology show that the knowledge is constructed through negotiation between individuals. For the critical researcher the case will be very different. My philosophical considerations are affected by my research paradigm as well, which happens to be the interpretive paradigm and in post –modernism, the realities depends on logic. Now I am going to elaborate different philosophical consideration of my study which is given below:

My Ontological Considerations

The ontology is a paradigm, way of being and becoming in the social world. Actually it is reality. It will be in here or inside of consciousness and it is inter-subject. Moreover, it is sources of knowledge. In any research, there should be reality. So in my research, the reality may not be single. There will be different learning and teaching strategies used in my research as assumptions. These are the essence of the social phenomena being investigated (Cohen, Manion& Morrison, 2007).Likewise, ontological assumption concerns on the nature of the world and human being in social contexts (Bryman, 2001). Supporting this view, my ontological consideration will be the reality of the social contexts and the nature of the world and human being towards the mathematics. Also, theories are built and constructed from multiple realities in my paradigm. We have to look at different things in order to understand a phenomenon because the theories are shaped by the cultural and social contexts. My study focuses

on mental, social and cultural phenomena. Actually, my study describes the multiple realities which are different to each other.

My Epistemological Considerations

My epistemological considerations are founded in the culture where I grew up and in the society which I feel my own. The personal epistemology means the way how one develops the conceptions of knowledge and knowing and utilizes them in understanding the world. We know that knowledge is not in the scientific study of things. Also, it is not only knowledge, obtained from the book but it is a kind of inter-subjectivity of my research participants as well as myself. Likewise, the source of knowledge for me is the knowledge of the participants in my research. I can get the knowledge what they use mathematics in day to day life and how they can relate their mathematics with school mathematics. Moreover, I consider my own experience as a student well as a teacher. That means, I will get knowledge from my own experience as well which are my epistemological considerations. I have already said in chapter one that my parents frequently used mathematics in their life although they did not know about the mathematics. So, the experiences of my parents also are sources of my research.

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 & Morrison, 2002). They further ask whether it is possible to identify and communicate the nature of knowledge as being hard, real and capable of being transmitted in tangible form, or whether knowledge is of a softer, more subjective, spiritual or even transcendental kind, based on experience and insight of a unique and essentially personal nature. I have included different episodes, poems, pictures ,

dreams and narratives of my experiences as a mathematics learner as well as a teacher and tried my best to reflect it critically in my own learning experiences.

Axiology

We know axiology is the theory of values. As a researcher of mathematics, I have my own values and beliefs. My values and beliefs will help my research. While eating a meal, I think that I am using mathematics. While walking on the road, I believe that I am using mathematics. As an interpretive researcher as well as auto-ethnography, I will take some views of others as well as prepare some notes of my feelings so that these will be powerful for my view. It may be correct or not. It means that my beliefs may be correct or may not be correct. I will take new ideas from others' views which will benefit my research. The values or my beliefs are different to each other or may be same. In this stage I remember that all matter in this universe has their own values, changing and constant values and there is hierarchy of values. Each and everything in this world has its own value. So, I respect all the values and I will use my values in my thesis. Similarly, I will interpret the meaning of my values by exploring my own experiences. On the way of doing my research work, I have mentioned about my teacher who punished me, which might be wrong to other respectful teachers as well as disrespectful to the value of student and teacher relationship. Richards (2003, p.36) explores that Axiology deals with the truth or worth.

Research design

The research design is a as road map is to a blueprint or a contractor. It tells the researcher how to progress that's why it is very important for any researcher. According to my philosophical considerations as mentioned above, I want to apply the best research design so that my ontological, epistemology and axiology

considerations are fulfilled. There are different paradigms in research area. They are positivism, post-positivism, interpretive, criticism, modernism etc. among them; I will apply interpretive, criticism mostly. The paradigm of interpretive expresses my own beliefs as well as the participant's beliefs. Moreover, it enables me to apply materialization as the trait of my inquiry.

Interpretive research paradigm

It is a qualitative research paradigm. It is also known as constructivist paradigm. So as a constructivist researcher, I used this paradigm in my research as a supportive research paradigm. Interpretive research paradigm is used to illuminate the beliefs, values and predispositions that underpin social action and is a great way for researchers. For example: we can say that the understanding of students' quality of engagement in learning, whether they are talented or not. Interpretive research paradigm focus on action and it begins with individuals and set out to understand their interpretations of the world around them. The theory should emerge and must arise from particular situations; it should be grounded in data generated by the research act (Glaser and Strauss, 1967 as citied in Willis, 2007). It strives to understand and interpret the world in terms of its actor. Here meanings and interpretations are paramount. This research paradigm says that people are "influenced by their subjective perception of their environment their subjective realities" (Willis, 2007, p.6). Likewise, Interpretive is concerned primarily with generating context-based understanding of people's thoughts, beliefs, values, and associated social actions (Taylor, Steelmaker, and Luitel, 2012). As an interpretive researcher, I have attempted to seek understanding, clarification and extrapolation to similar situations of stage of reflective writings in my study. Similarly, It helps to generate new belief and

knowledge my lived experienced that‘s why I want to use this paradigm in my research.

Critical research paradigm

Critical research is another research paradigm. We contend that critical research is significantly different from positivism and interpretive. We can argue that the critical paradigm is not an exclusive alternative to interpretive or positivism: Criticality is a different perspective on the analysis that can add up to critical-positivist or critical interpretive research whereas non-criticality, we (Niehaves, Bjorn, Stahl, Bernd Carsten, 2006, p.6) argue, is the logical complement to criticality which means that the particular research(er) does not take a critical perspective. In this way, the critical paradigm can be characterized by the critical intention to change reality and the wish to emancipate alienated individuals. It tends to concentrate on topics where alienation is most visible and it is based on a set of theories, which reflect the critical intention. Likewise the role of critical researcher is to change of society. Positivistic paradigm offers no space for articulating the researcher's unfolding 'self' during the research process (Luitel, et. al., 2012). In these points of view I select the critical research paradigm for supporting my research. Also, the paradigm of criticalism uses a transformative ontology of critical selfhood (Kincheloe, 2003) and enables me to critically examine assumptions, values and beliefs invisibly embedded in my thinking and action. I support this view because the critical research is a kind of transformative knowledge of self which examines values and beliefs of society by critically thinking.

Postmodern research paradigm

It is relativism research paradigm which is against modernism. Its goal is to disrupt the presumed primacy of any paradigm especially positivism. Likewise, it is to

break the traditional. Writing as inquiry, reading is the research method of this paradigm. Also it is unfolding discovery. It gives the multiple logics and multiple representations.

Although my research is more oriented towards interpretivism and criticalism, I have taken postmodernism as a supporting referent to know multiple epistemic expressions, logics. This paradigm is offers me to support to my beliefs and understanding about constructivism and social constructivism in teaching learning as new method to improve my pedagogical practices. Thus I have tried to include some narratives knowingly and unknowingly which are my learning and teaching experiences. Mirchandani (2005, as cited Sharma, 2012, p.15)

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

Similarly, Taylor (2009) describes that post modernism in qualitative research exists from the literary criticism which applies skepticism and conscience as platforms of inquiry. Furthermore, he advocates that post modernism elicits both fear and favor via its basic principle, be suspicious of all grand narratives (including that of postmodernism, respond to its critics, not without irony).

Methodological approach

To complete and have a good thesis, I will employ different research methods such as writing as inquiry (narrative writing), semi structure interviews and critical reflection of personal professional experience. According to my data, my research is based on auto ethnography. So, I am the primary source of data. There will be multiple

methods of textual presentation in my research such as narrative writing, reflective journal /dialogue, story writing/ poems. This method will support my research in interpretive way.

Writing as Narrative inquiry

Narrative inquiry is a relatively new qualitative approach. It is the study of experience understood narrative. In other words, it is the way of thinking and studying lived experience. So, as a mathematics teacher and someone interested in mathematics, I want to relate our daily life mathematics and school mathematics. Especially, I want to focus my lived experiences of mathematics learning that what the mathematics is, and what the uses of mathematics in our daily life and how we can expose the mathematics of culture in school so that the students have benefit. According to my bases of study, it should be better to use of a narrative inquiry. Narrative inquiry thinks narrative about experience throughout inquiry. Narrative inquiry is a way of understanding and inquiring into experience through "collaboration between researcher and participants, over time, in a place or series of places, and in social interaction with milieus". Stories and conversations shall be my way of unfolding and finding meaning in my lived experiences (Cohen et al., 2000). Creswell (2008, p. 512) asserts that a narrative research design" focuses on studying a single person, gathering data through collection of stories, reporting individual experiences, and discussing the meaning of those experiences for the individual". Also, narrative inquiries are listening to participants view or told stories as their lives in particular contexts; interpretation of the stories lived and told is ongoing and essential process. That they "give shape to what … (they) hear, make(ing) over ... (participants) stories into something of … (their) own "(Coles, 1989.p.19).Narrative inquires actively attend to and listen to participant's stories knowing. Thus, Narrative

inquiry is the process of gathering information for the purpose of research through storytelling and it is the study of the ways human experience in the world. Interviews, Field notes, journals, autobiographies and orally told stories are all methods of narrative inquiry. In my research, these are introduced frequently.

Critical reflection of personal professional experience

Reflections involve learning critically from and through three key elements .They are doing, feeling and thinking. So in my research, I want to put the meaning of mathematics beliefs and assumptions towards the local mathematics and school mathematics of my experiences with critical reflection of own experience as a student, as teacher and as a parent. Actually reflective practice is an in –depth conversation open about what we do, how it works and why we do it so. This kind of writing promotes the deep learning, increase awareness and improves thoughtfulness before and during practice.

Quality standards

As a researcher, I can say that quality standards are very important for research. It includes educational research which is indispensable. Guba and Lincoln (1989) suggest that qualities in a research of any kind, including educational research are indispensable for evaluating the quality of disciplined inquiry (as cited in Koul, 2008). Furthermore, quality standards assist the researchers in keeping an eye on the process of research structure (Guba& Lincoln, 1989 as cited in Koul, 2008). So I agree with Guba and Lincoln. There are different research paradigms having different quality standards. There is a great need of quality standard in any research. Without quality standard any research cannot be effective and fruitful. The following are the quality standards related to my research:

Verisimilitude

Verisimilitude is a kind of quality standard. The degree by which the reader can tell how true and realistic the stories I unfolded is defined by this quality standard (Ellis &Bochner, 2000). There are four criteria within this quality standard. They are crible (a number of strategies), transferable (rich detail), dependable (process audit trail, emergence) and conformable (data audit trail) (Guba& Lincoln as cited in Koul, 2008). As cited in Sharma (2012), Marcus (1994) asserts verisimilitude as a set of laws set by conversation and as a mask that presents these laws as a text's submission to the rules of a particular genre. Also, he describes that is a text's relationship to reality and it asks some questions about representation in a text consistent with real and about the truth fullness of text. Furthermore ,Marcus(as cited in Pandey,2010,p.24) describes and clarifies, "Verisimilitude can be described as the mask a text assumes as it convinces the reader it has conformed to the laws of its genre, in so doing it has reproduced reality in accordance with those rules" (p.580). So, the episodes, poems and narrative writing of own experiences are very important and valuable to fulfillment of my quality standard when the followers can feel my experiences and compare with their real life.

Transferability

The transferability is also a quality standard. In this quality standard, the readers may attempt to find similarity between researcher's personal experiences and their own, as well as the degree to which conditions overlap (Guba& Lincoln, 1989). According to Bryman (2004, as cited in Dahal, 2013, p.43), transferability is how the research findings are applicable and similar to others across educational settings. Similarly, as (Luitel, 2009) says that transferability doesn't mean replicabilty of the entire research program; rather, it is about the adaptability of research aspects to a

new context. In my view, transferability is the quality of being capable of exchange or interchange. Therefore, I have included many episodes, poems, narrative writings related to my own experiences of my life as a student as well as a teacher which might be similar to others educational setting and is applicable .

Pedagogical thoughtfulness

It is also another quality standard of my research. After reading this research, the readers will be able to find some narratives related to their life and reflect it in their own life. It means that it will have an impact on the readers' pedagogies. Van Manen (as cited in Luitel, 2009) writes that present and future readers of my texts are evoked to question, reflect and examine their own pedagogical practices. I think that narratives and my experiences reflect and give light upon my past activities of learning / teaching mathematics in different context which help to connect with present knowledge of learning mathematics. So, I have pedagogical thoughtfulness to find the gap between my past learning/ teaching experiences and present knowledge of learning and teaching. Moreover, reflecting on my life experiences may help the readers to see and know their pedagogical thoughtfulness.

Ethical consideration

On the way of thinking this consideration, I remember my head teacher who always says to the students, "*Be good and do well*" which is the notion of ethical consideration. He was always good and did well. I am impressed with my head teacher so, in my research I want to explore ethical consideration. Researchers should also be aware that each stage of the research sequence may be a potential source of ethical problems (Cohen, Manion et al. 2000). There are some ethical problems raised in my research. So, I will be aware of that kind of problems. Anderson (1998) emphasize that all studies which involve people should consider ethical issues and

responsibility of the individual researcher to see to it that any risk which may affect the community or the individual involved in the study is minimized. Likewise, Josselson (2007, p. 537) asserts that "narrative researchers have an ethical duty to protect the privacy and dignity of those whose lives we study to contribute to knowledge in our scholarly fields." So, I will maintain the confidentiality and privacy throughout the research. Also, Creswell (2007) argues that no matter what qualitative research the researcher is going to undertake they face ethical issues during the data collection, the analysis of the data and the final report presentation. It will happen because the researcher and participants are human beings. There will be certain boundaries that cannot be crossed so that we have to consider about the ethical issues.

As Sharma (2012) has cited (Cohen et al, 2000) that there are two types of ethical position, absolutist and relativist ethical position. The absolutist view holds that a clear set of principles should guide the researchers in their work and that these should determine what ought and what ought not to be done. But a relativist position would argue that there can be no absolutist guidelines and that ethical consideration arises from the very nature of the particular research (Cohen et al., 2000). In the process of my study, there may be spoken about many people to be consideration. So, I am not only a learner and a teacher of mathematics, I am also a person of a society and responsible for my society. I don't claim that my experiences which I have presented during the study are common to all students, teachers and teacher educators. For clear understanding of my study, I have cited different literatures and which are maintained by references.

Chapter summary

In this chapter, I have discussed about the methodology, different paradigms, quality standards, philosophical and ethical consideration of my research. There are

multiple paradigms in my research design where interpretivism paradigm helps me to explore my lived experiences of my pedagogical practices as learner, teacher and researcher. Similarly, I have touched upon criticalism and post modernism research paradigm to support my research paradigm. I have realized that this paradigm contributed during the research journey.

CHAPTER IV

MORPHING PURE MATHEMATICS TO GLOCALISED MATHEMATICS

Chapter overview

This chapter portrays the teaching mathematics through materials used in our daily lives. I have presented my personal experiences as a student as well as a teacher. Here in this chapter, I have presented different experiences in the form of narrative, stories, dialogue and poems. All the stories, poems presented in this chapter are related to the mathematics learning through incorporating glocal knowledge. The theme of the chapter is to elaborate or morph pure mathematics to glocalised math. Many teachers begin to implement pencil and paper teaching methods, as well as more written assignments. It means, some teachers teach the students what the content is there in the text book. They don't connect the content with our daily life. As a result, teachers use the same method or teaching cycle over and over to teach the content in the curriculum. According to Steele &Arth (1998), this is a leading source of mathematics anxiety. That's why the huge number of students is not interested in mathematics learning. The large number of the students is failure in the mathematics (Baral, as cited in Republica, 2013). For this I am going to find options to eliminate these problems. In this chapter, I introduce my experience on learning mathematics as food, games, farming and so on before joining the school at first and then I explain my learning journey of formal mathematics and feel that everyday problem solving as rote memorization. I also explain my teaching experience of mathematics through glocal knowledge and so on.

My research question, *how did my experience change in my perception about learning /teaching mathematics as a "pure math" to "glocalised" subject?* is more related to the use of materials used in everyday life. Especially I try my best to introduce the mensuration chapter of grade ten. Although the students have already known this chapter in earlier classes, they feel that it is very hard to study. There are many misconceptions and difficulties in learning mensuration. They are confused to compare different solids of the text book with the everyday materials.

Episode-1

Mathematics as food, games and farming

I was born in a family in the village of Harisiddhi ward no.7, Lalitpur, Nepal. I am the second child of my family. My elder sister expired when I was a 6 month old baby. So I do not remember her. My parents knew about the importance of education so they admitted me to a private school. As I was physically weak, I could not go to school by bus. So I was again admitted in government school situated at my village by my grandmother. My childhood was very miserable.

The education is the mirror of the society. It helps human beings to live and give the knowledge to care overall of human beings. At that time, when I was a child, my parents had lack of education, so they had many problems. After that they knew the importance of education and I got the opportunity to study.

Most of time, I spent my childhood playing different games such as marbles, and playing cards. Likewise, I spent most of time to help my mum at kitchen as well as in the field. In the kitchen, my mom cooked yomari (cone shaped) and chatamari (circle

Figure 1: Chatamari

Figure 2: Nanglo

shaped) which are very delicious typical Newari food which helps me to consider the concrete example of cone as well as circle in geometry. Also my mum used different kinds of material such as Nanglo, Chalani, pots etc. There was a small family with my father, my mother, and my younger brother. The economic condition of my family was very low so my father and mother had to work hard. My duty was to look after my brothers and cook. My father was a carpenter as well as a mason. He used me to work some time and I am interested doing the work. I always helped my father to make chairs, doors, window, tables, charkha, etc. with measurement.

Similarly, I learnt the mathematics of cooking when helping my mother. My mom could estimate how much rice was necessary for the family without any calculations. Likewise, she used different types of materials which are related to the mathematics. While working on the field, she divided the land into rectangle form. Although she had no mathematical knowledge given by school, she can do all works in land where there is a maximum use of mathematics. Likewise, my father who also lacked formal education, knows mathematics of a carpenter, mason. He can make cupboards, chairs, tables etc. with correct measurement. At that time I am learning the mathematical knowledge from the beginning. Moreover, the moment while doing at the land, helps me to consider the mathematical knowledge. I have learnt my mathematics with different doing and playing of my society as what Scribner (1984) says that "the mathematics of different groups in everyday settings showing that mathematics knowledge is generated in a while a wide verity of contexts by both adults and

Figure 3: planting rice

children." My parents were uneducated. Nevertheless, they could read and write properly. As a carpenter, my father has experience to calculate the total volume and cost of making the doors, window, table, chairs etc. Also as a mason, my father can estimate the total bricks for making wall.

Before joining the school, I have an opportunity to see and observe my father's calculation of volume of wood for making furniture, bricks for walls without any knowledge and understanding of mathematics. He prepares different shapes of mathematics. Every person in the village came to call my father to make and fix the roof and my father did that work very easily.

The mathematics which is related to our daily life cannot be forgotten. It can be used in every step of life again and again, that's why we keep it important and are curiosity to use. The mathematics which my father always used is very important for us. So, this kind of knowledge related to our everyday life, should be connected in the mathematics teaching and learning process so that the students can learn the mathematics by interesting way and have meaningful knowledge.

The child age is the age of playing and playing. In the same way, I also played different games. From those games, I gained a lot of knowledge. Specially, I got the mathematical knowledge. I spent most of time playing games with my friends. I used to play marbles every time. I always won while playing the marbles.

By playing the marbles, I learnt about the mathematics of straight line. While playing the marbles, we have to try to make sure that the marble should be in a straight line otherwise we will fail to win the game. Similarly, the shape of the marble is kind of sphere which is taught in school math. The teacher has taught it by drawing the figure on the blackboard. We, the students feel that the shape of sphere is as circle shaped and confuse to compare sphere and circle. By the knowledge of marble, it is

easy to separate or distinguish between circle and sphere for me. The circle is two dimensions and the sphere is a three dimensional solid. Children clearly deal with ideas of shape, space and pattern when they play with blocks (Lee-Lundberg, 1996).

Likewise, I use to play the cards that taught me about the addition.

While playing the cards, we have to pair the card of same (Jodi Patti game in playing cards). It also helps to learn one to one corresponds. Similarly, it helps to promote memorization which is most important in mathematics learning. It develops logical power. Likewise, by playing cards, the students will begin to gain familiarity with numbers as 1, 2, 3, and so on, suits and characters involved in cards. Most card games promote math concept, matching and pattern recognition. Also, playing card games entail a great deal of strategy as well as skills such as statistics and probability.

Figure 4: Playing cards (used on rotation)

Moreover, I used to play dandibiyo, at childhood which inspired me to learn mathematics very much. Once, while I and other friends were playing the Dandibiyo game, I threw the Biyo by Dandi which hit to a person at the mouth unfortunately he was bleeding and that made me very frightened. I will never forget this activity. Although, this made me remember the

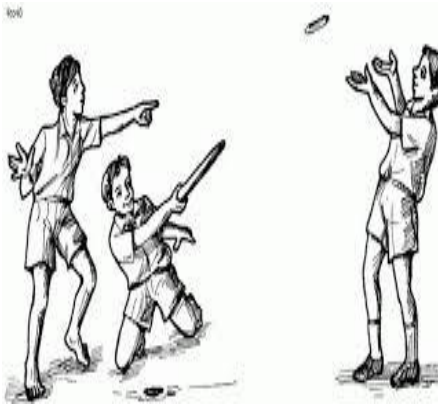


Figure 5: playing Dandibiyo game

accident, it also helped me consider how I learnt my mathematics. In fact it is played between two teams; each has one or more players. There is one 1 to 1.5 feet long rounded firm wood (Dandi) and one short sharp ended wood (Biyo). A shallow elongated pit is dug in a playing field. The Biyo is placed on the top of this pit. Dandi is put beneath the Biyo and is thrown towards the opponent in 45 degree (best angle).if the opponent catches the Biyo, then the thrower is out if not, that means the Biyo lands on the field, then the thrower continues to make thak and strikes the pointed end of the Biyo with Dandi, a successful strike would raise the Biyo in air allowing the thrower to bounce Biyo in air. One bounce is counted as one thak. The thrower makes as many thak as he could before the Biyo falls off. In this way, it is played and from this kind of game, the concept of counting numbers, multiplication and so on can be gained by students.

Similarly, bagchal and rumal lukai are also local games which inspire me to study mathematics. So far as bagchal is concerned, it is played on a board or a square place between two persons. Thus it can be played anywhere so long as pieces and a board are available and two players can sit comfortably. By this kind of game, the students can learn the geometrical concepts as straight line, square, intersecting lines, triangles and angles.

Figure 6: Bagchal game

We know every culture has its own way of living to accomplish the revolution life. What is evident that, all knowledge is first of all local knowledge (Gerdes, 2005, p.53) and game is one of the major components of it? In my daily life, I always engaged in my cultural practices. I played different games and participated in sports and worked in different places. These kinds of activities are the most important for

the children because they learn mathematics from these practices. Ethno graphic approaches often point to cultural aspects of children's activities as ingredient to children's learning environment (Clark, 1983, p.85, as cited in Poudel, 2008, p.53). Although this kind of approaches are more sensetive to the cultural features of practices ,they do not offer frameworks for the systemic analysis of mathematical environemnts nor how such environments might come to be represented in individuals' activities.similary, in this kind of approches , students' learning environment might be good and construct their core ememgent goals as saxe (1991) argues. So, my argument is , knowledge of local games plays a vital role in learning mathematics in the classroom.

Episode-2

Everyday problem solving to rote memorization

It is difficult to remember the past. However, we know the past is experience and the present is experimentation and the future is result. So I am going to reflect on my past experiences as a mathematics student. I cannot remember my first school. I remember more about my second school (Shree Harisiddhi lower secondary school). It is situated at Harisiddhi V.D.C, wad no. 5, Lalitpur which is supported by government. There are about 20 to 30 students in each classroom and most of the students are pure newari[7] (Maharjan). We only speak newari language (local language of Kathmandu valley). Although, our

Figure 7: My school

[7]"Newari" is a kind of language (Tibeto-Burman) spoken in Kathmandu valley of Nepal

books and teaching languages are in Nepali, we all speak only newari amongst each other.

It is difficult to teach a foreign language. For me a student of newari culture, while reading and writing, there is only use of national language Nepali. This made me difficult to learn mathematics and other subject. The mathematics should be taught in local language so that the students can easily understand.

My learning is started in such condition that there is no difference between my home and school. I remember that my mathematics teacher Arithmetic and Algebra. They teach me the mathematics 1, 2, 3.... in the beginning and also remember my mother's counting the coins. She uses to count the coin of one rupee as chhataka (1 rupee), nitaka (2 rupees), sotaka (3rupees), petaka (4 rupees), nyataka (5 rupees), khutaka (6 rupees), ndhetaka (7 rupees), gutaka (9 rupees) and jhitaka (10 rupees). When I was in the first grade, I learnt about the counting numbers with my mother's counting style. Likewise, while my mother counts the rice, wheat, she used to fachhi (one pathee), nifa (2 pathee), and sofa (3 pathee) and so on. These are the counting numbers of newari culture. Similarly, I still remember my mother that she separates ten coins of one rupee one by one and lastly she adds and says about how money she has.

Figure: 8 counting the coins

The mathematics which is taught in the school (counting number) is related to our daily life. My teacher drew one picture for 1, two pictures for 2 and so on. At that time, I connected the counting the numbers with my mum's counting the coins as well as measuring the rice, wheat. I perceived that mathematics taught in school, is not

distinct from everyday mathematics because all knowledge is attached with our society it may be in family or group of people. Similarly, the individuality is the expression of set of socio –culture experiences class. So, it is better to relate the experiences in the classroom. According to Lerman (2006, as cited in Sharma, 2012), cultural prospective sees all meanings as socially produced, physical experiences too being interpreted through the local cultural practices.

Likewise, I would like to share about one interesting counting numbers story that I always saw and learnt in my house. In Newari culture, most of the women have to prepare wine for celebrating different festival for workers and so on. As my family also belongs to newari culture, my mother used to prepare wine. While preparing the wine, my mother's counting style was very different. She counted the numbers in

Figure: 10 process of preparing wine

different ways while keeping the water in the big clay pot made. She always drew lines on the pot by small stone like tally we do in statistics. For preparing the pure wine, she used to draw 3 or 4 lines and for normal wine she used to draw 6 or 7 lines. One day , I asked to my mother about this and she replied me that one line for one time water had kept , two lines for two times water had kept and so on. Again I wanted to know about more so I watched, "how does my

Figure: 9 conical pot where water is kept

mother put water into the pot for making the wine (alcohol)" and came to that my mother did her work by individually which was right. The figure shows the process of making wine in which the upper part is a pot of conical shaped where water is kept and in the middle part, a kind of pot made from mud (black color) where lines are drawn outside for memory of water kept and a pot for collection of wine from the air is kept under it.

By this short memory of my life explores the interpretation of my mother's own world by her subjective knowledge. We know that the subjective knowledge is the world of our conscious feeling and experience. According to Lerman (2009, p.186), "subjectivity focuses on how individuals are both the subjects in the sense of the actor in a discourse but are also subjected to the possibilities and limitations, the affordances and constraints.

Similarly, my learning journey is going such a way that I learn mathematics via text books in school. When I was in grade 6, 7 and 8, I got an opportunity to learn mathematics taught by our head teacher. He had a science background. He taught mathematics his own way which was different. He sometimes related it with the local context. As a son of farmer, he used to connect the mathematics with local mathematics. So, I start to get interest in learning mathematics. While teaching the mensuration chapter, he gives the example of the different types of land. He gives many examples of geometrical shapes before teaching from the mathematics book.

In the secondary level, I have an opportunity to learn mathematics with another math teacher. On the first day, I felt that he was great teacher for us. He looked like a 'bearded' political leader. All of the students were afraid of him. When my friends asked questions, he seemed very angry and scolded very badly. He completes our course in grade 10. Thinking mathematics as incomplete subject, we went to take extra coaching classes and studied mathematics very well there. In this coaching class, our mathematics tutor taught us Ptolemy's theorem by making it sound interesting with reasons while in our class, our teacher told us that the theorem should be memorized, and there was no reason. This made me feel like mathematics was a memorization subject. Likewise, the behavior of

My mathematics teacher

My mathematics teacher as ghost / horror

Who always frienghtened me in the classroom

My mathematics teacher as villain of movies

Always plays negative roles in the classroom

My mathematics teacher as hydrogen gas

Who always solve the question oneself

Nothing understand for those students

Who always afraid by him

My mathematics teacher as parrot

Who always teach what the content in the text book

No share and no relate with our daily life

Makes me and friends as rote learners

Symbols, formulae, figures are there

Which makes me, mathematics as meaningless

No responsibilities to the learners and their interest

My teacher teaches us meaningless mathematics.

mathematics teacher made me think of this subject as a nightmare. When studying in grade 9 and 10, there are lots of formulae and symbols to remember. In this point of view, mathematics is collection of formulae as well as symbols.

At lower secondary level I got a really good mathematics teacher that we wanted. It was because the teacher always connected the mathematics with day to day life. It was very easy to have the knowledge of mathematics. Quinlan (2004) suggests that teachers should begin by allowing students to explore concrete examples of a concept before presenting its definition, and that the formal terminology and symbolism associated with the concept should be introduced much later, after students have developed a sound grasp of the basic ideas. This is against the traditional paradigm in teaching mathematics. We should follow as what Quinlan (2004) suggests.

It was around December, 2005. I was researching colleges for further study. So, I joined a University to study mathematics but I left the study because I was confused with the mathematics learning in that university. I cannot find the meaningful learning of mathematics. At that time, my close friend KC, Harry and Tamrakar joined that college. We were all confused with the mathematics learning. We are learning in the mathematics by rote learning method only. The professor comes to the classroom and writes down the notes of the mathematics. At that time, I took mathematics as only news reading and rote learning. We cannot get the actual meaning of mathematics. What we are learning mathematics and how, there are lots of confusion in mathematics learning. One day, while taking a class, one of my friends asks to professor, "what is the application of mathematics?" The professor answers," there are many application of mathematics what we are learning. It is difficult to use the theorems which are in mathematics because of low economic condition. Actually, we use mathematics in our daily life. For example: while drinking

a cup of tea, walking on the road, cooking in the kitchen, we can see the use of mathematics. I think the mathematics learner of Nepal is only for being mathematics teachers."

The mathematics teaching process is not changed when I reached to study for master's level. I wanted to study the mathematics meaningfully but I never got such a chance to get pure knowledge of mathematics. If the teaching process of mathematics is cordial relation between day to day life and mathematics of college, surely I will give force to study mathematics. There are lots of problem in Nepal. Out of them, the unemployment is one of the main problem .Every student wants to have good job after finishing his/her study. But the student, who learns mathematics, does not know the application of learning mathematics and that means there is not fixed job after learning mathematics. It is only popular for being mathematics teacher. If someone will ask for mathematics student about his/her aim in life, he/she will answer only for being math teacher. But in other subject as science, we can see lots of job as doctor, engineer, and pilot etc. so; there are fewer priorities to study mathematics in higher level. If mathematics teaching is according to the context of day to day life, the students may feel that mathematics is very important and want to learn, participate actively in the classroom. Similarly, if mathematics is taught as applicable in everyday life, obviously the students will close to study mathematics. Moreover, they would never hesitate learning the subject.

Figure: 11 Facilitating at K.U.

It was December, 2011. Looking for the college for further study, I met my friend KC on the road, I said to him, "Good afternoon, KC ji, how are you?" He replied, "Well, I am fine and you, sir?" I also said to him, "I am also fine. KC ji, have you passed the master degree? I left master level class. So, I have no degree now." He replied, "No, I also left master level class of the University. Nowadays, I am studying at Kathmandu University." I asked to him curiously, "why did you leave earlier University and joined new University?" He replied, "It was very difficult to understand the mathematics and its application. There was only rote learning, no meaningful learning. Similarly, there is no cooperating as well as constructive learning in mathematics class at earlier college, so I left and joined

Searching college

Searching the meaningful learning of mathematics

Running here and there

Reached at Kathmandu University

Nothing understand in the beginning

What the professor are teaching

What the professor are talking

Difficult to understand

Difficult to talk

Constructivist, cooperative, collaborative

As teaching method makes me active

Slowly and slowly thinking me as philosopher

Try to understand the meaning of math philosophically

ICT in mathematics makes me wonderful

And, learn lots of mathematics' knowledge

Very happy with this university, and its pillars

That makes me a teacher as well as a researcher

K.U. In K.U, we can find good environment in teaching process. The teaching process is socially constructive, cooperative, and democratized. The students have to think creatively about what they are learning. They have to relate it with their daily life." After talking to him, I also want to study mathematics in K.U. Even before talking to him, I had already heard about good performance of K.U.A teacher, who is also teaching science where I teach, had told me about this college. Therefore, this was not new for me. But his confidence talking about learning mathematics and being a good teacher inspires me to join and study well. As KC, I find those facilities that I want. In fact, I am very happy to say that I am student of K.U where the teaching process is very effective and make the students as good teachers, facilitator, and trainer and so on. Actually, the classroom is totally socially constructive and all facilitators relate day to day life materials to teach mathematics that inspire me to study.

Episode-3

Being there and here

I have been teaching since 14 years. In this period, I have got a lot of experience on teaching and learning. When I was studying at grade 10, one of my friends who is junior to me asks to me,

Pokhrel (my friend): "*What do you want to be in future?"*

Me: (immediately), I reply to her," I want to be a mathematics teacher

. "Again, she questions me,

Pokhrel: "why do you want to be a mathematics teacher? It is a hard subject. Most of the students don't like this subject. I also don't like this subject either."

By this question, I am confused with her and think," why does she says so?" so I ask to her,

Me:"Why do you think that it is very hard subject? I think it is a very easy subject. It is used in our daily life. While studying mathematics in the class, I always compared it with mathematics in my life. So I thought it was very easy. It is important for all subjects which we study in the class. But one matter is that the mathematics teaching in our school is only centered in text book and taught to the students in one way and thinks the teacher as everything. I want to change how the students feel; mathematics is no so hard. It is easy.

By listening my views, she became very happy with me and said to me,

" thank you my friend, best of luck!"

We know human beings are social animal. They are creative and greatest animal of the world. There are lots of requirements, need by human beings. As a human being, you will have an aim in life. Someone wants to be a doctor; someone wants to be teacher and so on. My aim in life was to be a mathematics teacher. The image of mathematics is as a foreign subject (Luitel, 2003). All the students and parents think that mathematics is a very hard subject. In my opinion, it is not so hard. This concept is just taken by the behavior of the teachers. There should be a change in the teaching style and the teachers should be open to give examples of every day materials in mathematics teaching.

Because of my ambitions to be a teacher, I engage myself by taking coaching classes of students of my own school where I studied with my some of classmates after finishing the S.L.C. examination, In the beginning, I teach the students in a simple way according to my experience of a student life. All of the students who are studying with me are very happy with me. Actually, in the first day of my teaching, I teach English subject to one of the student of grade 8 .Although there is only one student, I was very nervous in that class because it is my first day of class. This is how I started

my teaching profession. After two years, while studying at grade 12, my lovely head master gave me a great opportunity to be teacher in my earlier school. I become formal mathematics teacher of my school as well as an assistant accountant. Actually, I only wanted to be a teacher not an accountant but I had to do because I had mathematical knowledge. I feel very happy being an assistant accountant too.

I think that a person who teaches to the students, only a teacher. Having this concept, I choose to be teacher. But the teacher is not only the teacher who teaches to the students. He/ she have to transform his/her knowledge in different way. I mean, I have the knowledge of mathematics. I had to handle the account of school. In fact, I had a very little knowledge of account but there is enough use of mathematics so that I am interested to be an accountant. By this conception, I conclude to say that mathematics is everything .It is used in our daily life.

The value of mathematics is important. It is counted. So far, I had only experienced to teach small class of students. But when I had to teach the students of the class 5, 6, 7, I found out that there were more than 40 or 50 students. I thought it would be very difficult to teach them. But that was not to happen. It was fairly easy to teach them. All the students liked me and my teaching style. Slowly and slowly, I teach to the students of grade 1 to grade 9 about mathematics and science. In the beginning, I teach the students without using any materials. I focus only on text book. I only thought about completing the course .I follow the teaching method what I knew. Most of the students are afraid of me because they found math hard work. If anybody didn't complete their assigned work, I used to give great punishment to them.

Imitation is an early developing ability that allows children to acquire skills and behaviors from other people in their culture. We can say that children learn by observation and by imitation sometimes. It means that learners follow the rule and

regulations of their guru as teacher, parents etc. similarly, I am also a student's of some teachers. In the beginning, I followed what my teachers do. As Luitel (2009) "being there: we need a global justifiable. According my experience, I would have done only global context. Here globalization refers to process of international integration arising from the interchange of world view, products, ideas and other aspects of culture.

It could be June of 2000; I used to teach optional mathematics in regular class and compulsory mathematics in coaching class. It was at 4:30 pm, I entered the class to teach the students. "Good afternoon sir." the students of grade 10 did their duty in the response of my entry into the classroom. There were about 20 students from the newari community. For a while, I thought, "The teacher is respected and demanded by students. How great the teacher is? The students always obey their teachers. What a wonderful experience that teachers have." Thinking such kind of matters in mind, I was going to start my class and said, "Well my students. Let's start the new unit pyramid of Mensuration." The students were silent for a while after listening what I had said to them. I wrote the definition of pyramid, formula of the total surface area, area of base, lateral surface area etc. Then I picked up a book from the first bench, turned the exercise of the pyramid and solve the problems of book. I explained all the process that I followed. One of the students, named 'Samin' asked surprisingly, "sir how did you learn all these? You have solved all the problems which are difficult to us." the question was raised by Samin as just a representative of all the students because I found that most of the students were only copying the solutions what I had done on the blackboard. They were talking to each other about the difficulties of the solutions of problem.

The question that Samin asked indicated towards my way of learning mathematics. He wanted to know about my learning style. He might have thought that learning mathematics was very different than learning the day to day life and could not make any contextual meaning from my teaching process. He was not satisfied with me in the sense I was failing to provide conceptual meaning. Knowingly or unknowingly I made the students passive receiver of knowledge from me. In fact, I was at fault. I had to make them active receiver of knowledge from the teacher. If the students were not active, then there was no meaning of teaching mathematics. Teaching mathematics is not only to solve the problems of the text book on the blackboard or make the students understand the solutions of questions but also filling new ideas in student's mind. We, the mathematics teachers think that the objective of learning mathematics is to pass the examinations with great marks. I was also attracted to do so and in coaching class, I had to attract to the students, so I followed what I did in the above stage. While I was at B.A. studying mathematics, I found mathematical analysis very difficult. So, I went to a tuition class with three other friends. In my tuition class, our tutor, Krishna sir did all the problems of analysis and gave the notes of that subject. We were all passive and filled copies with notes and solutions of problems which were not seriously done at college. We were very satisfied with this teaching style and wanted to be as Krishna sir, but when we attended the exam, we failed to do all the problems because we never learnt how to solve these problems. It was difficult to me succeed in exam. In this way, I was also the follower of rote learning. In my opinion, there was some missing bit to understand the mathematics. All theorems of mathematics were not related to our day to day life and my tutor did not try to incorporate glocal knowledge rather than rote memorization and coping theorems, rules and principals.

After three years teaching experience, I got a chance to participate in –service training of lower secondary level science for one month. It is given by secondary education development unit at Tripureswor. I received many ideas to teach in this training. I know the materials for teaching science in lower secondary level. Likewise, I found out about the different teaching methods such as practical method, field work, project work, deduction method, inductive method, demonstration method, problem solving method etc. Before participating in this kind of training, I didn't use any teaching artifacts when teaching my students. So, that most of the students were confused on some topics in science. After I received my training, I use the materials in all my teachings. In my experience, I realized that using materials in mathematics teaching, students were very actively participated in learning and connected with their everyday life mathematics as food, farming, games, cooking, different two dimensional and three dimensional solid shapes. Moreover, they compared the materials with their daily using materials. As a result, they were able to learn and understand mathematics easily. I didn't attend the class without any materials also suggested to other teachers about the necessary use of the teaching materials. In fact, this kind of training made me realize that I was unable to teach the students without the use of teaching artifacts. I started focusing on activities most of the time. Every year, I divide the students into groups where the students are arranged according to their capacity .I give an opportunity for weaker students to learn from more talent students. That means that the student learn cooperatively in my class. I have gained lots of skill, knowledge from that training.

Training, seminars, programs are taken as the professional development tools. There will be faced with issues of teaching process. The participants share their knowledge amongst each other. To be upgraded, anybody most be participated in

these kinds of programmed. I didn't know about the teaching methods before attending this training I used to follow text books. After the training, I know to use the artifacts that are related to the content.

Likewise, I participated in one month in service training in secondary level mathematics organized by secondary education development unit. One day, Dr.Function came to give us training. The participants were very happy to see him. We decided that we would ask him how we can teach vectors as a teacher of optional mathematics. According to our plan, one of my friends asked about it. He, Dr. Function replied," it is not so hard .we can teach it by using or relating our day to day life mathematics." We all were eager to know about it. Again, I asked, "what kinds of materials can we use in this chapter?" he answered, "we can relate it as force to open the door, close the door, velocity of airplane, displacement of book etc., are the examples of velocity which are applied in our daily life." By participating in this training, I got lots of knowledge and skills of teaching methods, teaching activities, and materials. Also, most important gaining was the sharing teaching stories between different teachers who participated in the training.

I use the knowledge and ideas in my classroom and the students are very pleased with me and my teaching activities.

It could be the year of 2007; I had got a great opportunity to have a ten month secondary level mathematics in service training organized by NCED, ETC. I and my friends were very happy to listen about the facilitating by Luitel. But we were unlucky that he did not come to teach because of other engagement. Instead, we got other trainers. We completed the training with more knowledge. All of the sessions were practical and related to our daily life. One day, while facilitating us by one of the trainer, a retired head teacher about the material used in mensuration chapter, he

used carrot as a cylinder. He cut it to many pieces to make cuboids. It took a long time. All the participants were feeling very bored apart from me. The trainer used local materials and tried to connect local knowledge and school mathematics.

To give the concrete knowledge of the content, it will be better to use local materials. But it is very hard to connect or use of that kind of material. So it is very challenging to use it in a classroom. Even the facilitator using the local materials cannot convince the participants than the teachers can use and relate it with the content? Anyway, I got new concept of mathematics teaching in this training about using local materials which empowered me to think and relate the content of mathematics with glocal knowledge. Also, it is very easy to understand the pure mathematics using local knowledge and give us concrete knowledge. After using this kind of concept in the classroom, I came to know that the students response positive and participate actively, and eager to change by teaching style. Before participating the training, I followed as my teachers did. The students did not give good response in this kind of teaching process and it was difficult me to give meaningful concept of mathematics. After having training, I got new knowledge. Moreover, I knew about how to behave to the teachers, students as well as parents and how can we use the local material in mathematics teaching in the classroom.

I learnt about how to teach mathematics by participating in different training and seminars. So nowadays, I always follow what I learnt in those trainings. Before entering the content, first of all, I start to discuss about the topics use in home.

> *One day, while teaching geometry in grade 9, I create the discussion about the use of geometry in home. I ask to the students one by one," what are the shapes used in your home? What kind of geometry can you find in your home?" the students answer, "The geometry are used in the roof of home, doors, window, rooms, chairs, tables, kitchen rack, Doko[8],Nanglo, jato[9],*

[8]Doko is made up of bamboo cut into longs straps and joined together, a Nepalese basket designed to tote heavy loads. It is used to carry materials for building house like bricks, cloths, dust, sand etc.
[9]Jato is a form of grinder and made up of stone, used to grinder rice, grains, pulses etc.

ugal[10]etc."In this way, they responded my question and I enter the content that I have to teach them in happy mood. Likewise, I use to connect local context in mathematics teaching. While teaching cone in mensuration chapter, I always give the example of yomari[11] because Students of school whom I teach are come from newari community. Every day I follow in such way that makes me very happy in teaching but sometime, I feel it is difficult to connect mathematics with day to day life. This takes too much time and there is the only a limited time period to teach a class. While teaching in the classroom, the presence of yomari made the students very fun and took interest in learning cone in mensuration. They saw the yomari and its shape and felt, the yomari which is used in newari culture, is a kind of cone. Some of the students compared it with other solids those which are used in their home. All students were actively participated in such kind of class, having fun and wonder. Moreover, they understood the content and its application in daily life. So, I want to keep my teaching in progress so that the learners can get more meaningful knowledge and skill. Similarly, one day when I was teaching algebra in class 9, one student questioned to me, "can we use the equation in our daily life? What is the use of equation in our life? Why do we study this kind of chapter in algebra?" I was very excited that the student was asking a wonderful question. He wanted to connect pure mathematics in our context or day to day life. At that time, I remembered my past. In the school level, I was very much interested in doing algebra. I thought, it

Life is an equation

Life is an equation.

Pleasure and pain are its variables

When we have pain, there is no pleasure

When we have pleasure, there is no pain

One who accepts is blessed

Our life is full of layers of equation

Equation is a panacea

This unfolds the mysterious of life

Life is an equation

Pleasure and pain are its variables

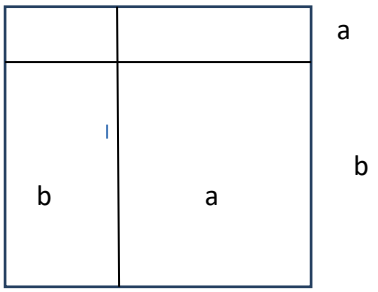
Of stars and planets

[10] The ugal is a material which is used to product the
machine.

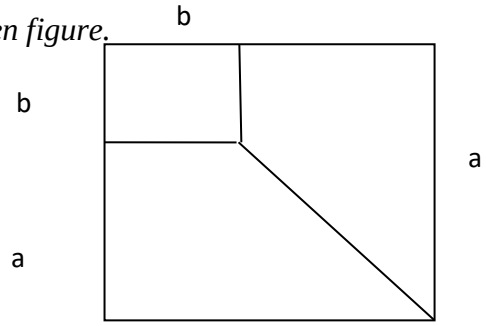
[11] A delicious food made by using rice flour in which postakari (chaku in newari say) is kept inside the yomari. It is made only in YomariPunhi. YomariPunhi is celebrated by Newari during the month of Mansir on DhanyaPurnima, the full moon day. In Newari "Y" means favorite and "Mari" means "sweet." YomariPunhi is mostly celebrated by farmers mark the harvest of rice.

was very easy and had very fun doing and solving all problems. I believed only the application of formula to solve problems not to use in our daily life. At that time, I was followed my teacher. My teacher said, "Algebra is only for writing and solving not for others." So, he (my teacher) always taught me how to solve the problems only. He never connected to our daily life. While teaching algebraic formulae, he wrote all the formulae on the blackboard as $(a+b)^2 = a^2+2ab+b^2$, $(a-b)^2 = a^2-2ab+b^2$, $a^2-b^2=(a+b)(a-b)$ *and so on. All the students memorized these. I did it very easily. I memorized by writing again and again because one day my teacher said to me, "If you hear, you forget, if you see you forget but if you do, you remember." So, my mind was gone to the knowledge what I got past from my teacher when a student asked me about the application of equation in local context. I wanted to close as my teacher did, but my mouth did not support it. The experiences what I got from different seminars and trainings empowered me to try and find an answer for the question. Also, while teaching the algebraic formulae, I taught the students in practically, and activity based. They are*

a) *Provide 20cm ×20cm ×1cm plywood or daft to each group and cut the wood according to the given figure. Arrange the pieces to get the concept of* $a^2+2ab+b^2$

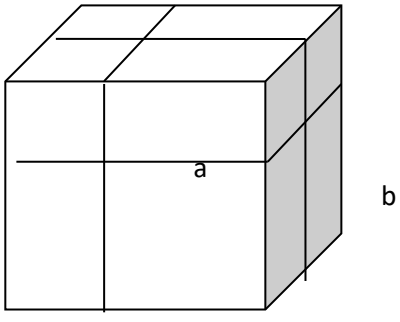


b) *Provide 20cm ×20cm ×1cm plywood or daft to each group and cut the wood according to the given figure.*



And arrange the pieces to get the concept of factorization of a^2-b^2.

c) *Provide soap for each group and say to all groups to make it as cube by using knife. Also say to all , cut the soap as figure given below:*



After arranging the pieces, verify the formula of $(a+b)^3$

The students thoug a t I b great teacher for them. If I failed to answer or behave as my teacher did in the past, surely, they would be far from me. So I tried to give answer giving different examples used in our daily life. I focused on algebra that it is also a method of calculating using simple equations to represent quantity and to show relation between them. Similarly, I tried to use it on measuring the length of our table, rooms, and doors and so on, and then the students felt that it is a part of our life. Similarly, when trying to teach age problem in algebra, it is mostly used to find the right age of the person. It's student's parent, friends or relatives. For example:

One year ago, the father was 8 times as old as his son. Now, his age is equal to the square of his son's age, find their present ages. This is a kind of age problem in mathematics which is related to relate to our daily life. It can be solved by algebraically as given below:

Solution: let the present age of the son be x years then, present age of his father is x^2 years. Then by question, we can write,

$$x^2 - 1 = 8(x-1)$$
$$x^2 - 1 = 8x - 8$$
$$x^2 - 8x + 7 = 0$$
$$x^2 - 7x - x + 7 = 0$$
$$x(x-7) - 1(x-7) = 0$$
$$(x-7)(x-1) = 0$$
$$either, x = 7$$
$$or, x = 1$$

When x=1, x^2=1which means that ages of father and his son are equal. So neglecting x=1, we have

x=7

and x^2=49.

Hence the present age of father is 49 years, and that of his son is 7 years.

In this way, the age problem / word problem of our daily life context can be solved by using algebra. The students felt that the question was very difficult to understand but the solution was very easy to understand. Likewise, there is a branch of algebra called "Linear programming " that deals with finding the best possible solution to an optimization problem while staying within prescribed constraints in any business or company. The students knew the real world problem which can be represent mathematically through algebraic expressions (called linear inequalities) and solution to these inequalities gives the optimum solution to the problem.

In the beginning of my teaching profession, I always used to follow what I knew. I gave notes and focused on rote learning. After having little knowledge of teaching learning process, many questions were raised. Can all students understand the solution effectively? Is it representing our everyday life? Furthermore, how can we connect our school mathematics with local knowledge or materials? These are the questions which were always surrounding my head and pushed me to change my teaching methods.

Episode-4

Mathematics as hard subject

It could be any day in August, 2008; I was checking the optional mathematics exam copies of grade 9. My theory is that first we need to check good copies. It means the best students of the class; I selected the first copy of the first girl. I checked it

which was good. After that I selected second copy as second girl named Ashmita to check. But unfortunately, she got lower marks in this subject. It means she was failed in my subject. I became very sad that second girl was failed and questioned me, "why had she failed?"

According to Gardner (1998/2004), "Every day I saw individuals with scattered profiles of strengths and weakness." There are different types of the students in the classroom. Some are extraordinary and some are less. The students are very talented in the class will pass in the exam and weak students are always fail in the exam. The mathematics is a subject which is very difficult to the students. Here, my student's even as second student of the class is failed in optional mathematics. There may be any cause to happen that condition. *I wanted to know about it. For this, I decided to study about her. I visited her parents to know about her. By discussion with her parents, I found out that her date of birth is 2048.12.26. Her originality is Butwal, NawalParashi. From 2050 B.S, she is staying at Harisiddhi Village and join to Harisiddhi school at 2057 B.S. her childhood was at Harisiddhi with their parents and friends. While talking with her mother, she said to me, "we are very poor. It is because we are uneducated. So, we have to do hard work to have shelter, food as well as cloths. We want to give education for children so that they will not feel as we feel today." Also, I knew about her family in detail. There is large number of members;*

So her mathematics is the number of brothers and sister to care, how much she has to give them the food? Is it the mathematics of her? Likewise, the number of sweep in the room is the mathematics of her .In this way; she is very busy on doing her own mathematics.

her parents have many problems to control the family. They have to work from the morning to evening as a milk man. They have no time to care for their children. Ashmita has to care for her younger brother and sister, clean the rooms in the house, and cook in the kitchen. So her mathematics is the number of brothers and sister to care, how many she has to give them the food? Is that her mathematics? Likewise, the number of sweep in the room is the mathematics of her .In this way; she is very busy on doing her own mathematics. But she has no time to do or practice the mathematics which is taught in the classroom.

I think there is no connection between the school mathematics and day to day life mathematics. That's why; she is very weak in mathematics. Although she is the first girl of the class 9, she is failure mathematics in the first examination. So my mind is gone to find the reason. I want to study about her.

Here, I am going to present about her view only.

I ask to Ashmita," how many members are there in your home?"

Ashmita: seven

Me: how many are there boys and girls?

Ashmita: 4 girls and 1 boy.

Me: who loves you very much?

Ashmita: my mom.

Me: what do your parents do?

Ashmita: sell milk.

Me: what do you have to do at your home?

Ashmita: I have to care for my brothers and sisters, have to clean the rooms, cook rice, teach my brother and sister and have to collect the money for milk which my

parents have sold in the morning because my parents don't calculate well and not have to collect the money.

By hearing her voice as mentioned above, I think she is learning mathematics day to day life. She can calculate cost of milk, estimate the cooking rice, putting salt in curry etc. so, I like to talk to her again.

Me: you are good in your home mathematics.

Ashmita: of course.

Me: why do you fail in mathematics at grade 9?

Ashmita: I know the home mathematics only which are not introduced in my school mathematics. I do home mathematics day to day life but I have no time to do school mathematics. So, I failed in mathematics.

Me: you have to consider or link your mathematics with school mathematics.

Ashmita: I will try.

Me: are you thinking the mathematics very hard?

Ashmita: yes.

Me: why?

Ashmita: I have no time to practice the mathematics. (Ignoring the mathematics what she does the mathematics in her home?)

She is not considering the mathematics of her day to day life. She believes that the mathematics is only what the teacher teaches in the classroom or the contents that are in the textbook of mathematics. I think she takes the mathematics as only the collection of formulae, collection of theorems which should be memorized. If she has got the environment of having the mathematics of what she does in home, surely she will do better in the mathematics. In this condition, again I remember to Professor and his one of the metaphor of mathematics is 'mathematics as foreign subject." I think

her also beliefs that the mathematics of school as foreign so that she feels it is hard. So, again I want to know about her and add some question.

Me: How much time do you give for mathematics for practice?

Ashmita: about 30 minutes. (Although she gives the time for mathematics in every step of life, she says so because she does not know about the mathematics.)

Me: Who is your best friend?

Ashmita: Miss Mathematician

Me: how is her mathematics?

Ashmita: she likes mathematics and she is very talented.

Me: how is she very talented?

Ashmita: she practices more and more. She always practices mathematics.

Actually, Ashmita is arguing truth that her friend Miss mathematician is very talented. I also know about her. She is rote learning. She does the mathematics only not other subjects. Her behavior is not so good. She does not have the knowledge of the home mathematics as Ashmita has. I think Ashmita is better than her friend in mathematics.

Me: which subject do you like very much and why?

Ashmita: Account. It is very easy for me.

In account subject, there is the calculation of money which is related to her daily life. But account itself is based on mathematics. There is lots of use of mathematics. Without the mathematics, account subject is not possible. So, why does not she connect it with mathematics? Is there no environment to connect day to day life with school mathematics in the classroom? Is the teaching process a traditional approach?

Again, I ask to her,

Me: What do you want to be in future?

Ashmita: engineer

I am confused with her and I ask her again*," you failed in mathematics. How can you study engineering?"*

Ashmita: I will try my best.

Me: it's ok. You have to do well in mathematics.

I think that it will be best way to teach mathematics is to relate it with the local mathematics. It is not enough to teach the students about the contents in the textbook. We have to give our pedagogical approaches to make mathematics contextualized. According to Luitel (2003), we must have to transform our pedagogical approaches to make mathematics contextualized and culture laden in place of foreign and culture free mathematics.

Episode -5

Mathematics as punishment

Figure 13: Punishment

It is sometime in 1987 .I was the student of at grade 2.The school where I studied had not enough infrastructures. There was no playground and no toilet. We had to go to the open field near to the school for short toilet. One day, I and my friends were busy for short toilet and gone far for the toilet. So we were late to return to the class. The mathematics teacher had already entered into the classroom. I said, "May I come in madam." At that time, she scolded me and said," you have to say 2 times table up to 10. If you are not able to say, you will be punished." This was her

words which seemed angry. So, I started, but I could not say at all. I had only read it two or three times and I could not remember it at all that time. She punished me very much that I never forget. She used stick to punish me. She, the madam focused only on text book. She always used to read as news teller at television in mathematics learning and we, the students had to follow loudly and learn what the content was there in the text book. We felt that she was a leader and known all about the world. We had to do according to her order. Nobody could ask the question. If

> *The Committee defines 'corporal' or 'physical' Punishment as any punishment in which physical Force is used and intended to cause some degree of pain or discomfort, however light. Most involves hitting ('smacking', 'slapping', 'spanking') children, with the hand or with an implement – a whip, stick, belt, shoe, wooden spoon, etc. But it can also involve, for example, kicking, shaking or throwing children, scratching, pinching, biting, pulling hair or boxing ears, forcing children to stay in uncomfortable positions, burning, scalding or forced ingestion (for example, washing children's mouths out with soap or forcing them to swallow hot spices). In the view of the Committee, corporal punishment is invariably degrading. In addition, there are other non-physical forms of punishment that are also cruel and degrading and thus incompatible with the Convention. These include, for example, punishment which belittles, humiliates, denigrates, scapegoats, threatens, scares or ridicules the child."*
>
> *(Committee on the Rights of the child, General comment No.8, para.11)*

some would ask the question, she became very angry and said, “The answer is in your book. You can see yourself.” I didn’t like this activity. Teachings should be students centered and connect to the local context so that the students can understand the mathematics properly. At that time, if she would link it as my mother counts the coins or another suitable example, it would be better for all students. She used punishment as the solution. It is not at all permissible to give such punishment; this is also against the law. Any teacher cannot even their parents can punish children like this. “Many people think of mathematics as a punishment or something that induces stress (Zaslavsky, 1994).” In the same way, I also feel the mathematics as punishment at child. Educational institutions are: 1) prohibited from using corporal punishment and 2) prohibited from using psychological punishments that offend the dignity of children and young persons (Ecuador, childhood and Adolescence code 2003, articles 40 and 41). So, the punishment should be prohibited in the mathematics learning and teaching should be students centered not teacher centered.

Chapter summary

The above episodes are related my lived experiences. Most of the episodes portray the need of the use of everyday life materials in mathematics classroom to understand mathematics for the students. This chapter introduced and focused on my research question “How did I experience change in my perception about learning /teaching mathematics as a “pure math” to “glocalised” subject?” so, I presented about my experiences of learning mathematics as childhood. The first episode is my learning experience as a child. It describes the mathematics I learnt in my childhood .The mathematics which are used in day to day life are important in school mathematics. The second episode explains my experiences of as a formal mathematics student. In this episode, I have presented that how I studied mathematics and how the

teachers taught mathematics. Especially what I perceive the use of everyday life materials in school mathematics is introduced in this chapter. All my experiences which are introduced in this chapter change my perception about learning and teaching mathematics a pure math to glocalised subject. Similarly, the third episode explains my experiences in teaching mathematics being there and here. In the beginning, I don't relate mathematics with everyday life. After having the different seminars and training, I start to relate everyday life materials and the students' take this kind of teaching method as interesting. So, I support to Luitel (2009) that 'being there ' represents ' signature stories' or 'data texts' constructed on the basis of my experiences as a teacher educator, whereas ' being here' entails subsequent interpretation of issues mentioned in the 'being there' stories with the help of my present perspectives. The fourth episode is concerned with one of my brilliant student Ashmita Pandey. She is a talented student in the class but she failed in her mathematics. She has her own mathematics which is not related to the school mathematics. This episode focuses that there should be the content which related to the local mathematics so that the students can learn mathematics while doing the work. By the sixth episode, I have presented my lived experienced about the punishment.

CHAPTER V

STUDENT RESPONSES TO GLOCALIZATION OF MATHEMATICAL KNOWLEDGE

Chapter overview

In the previous chapter, I presented some of my learning experiences as a child, as a formal student and as a teacher. There are some hindering and empowering factors which might have affected my conceptual mathematics learning. I have discussed some of my life experience and my learning process as well as teaching process in the beginning through traditional classroom. This chapter deals with my experiences as a mathematics teacher. In this chapter I have presented and discussed how I have incorporated the glocal knowledge in the classroom and how students feel about the use of glocal knowledge in pure mathematics. Also, this chapter shows the relation between foreign (Luitel, 2003) mathematics and our local mathematics. Moreover, this chapter explores about the glocalization of mathematics. The word *glocalization* is the practice of conducting business according to both local and global. In other words, it is a combination of the words "*globalization* "and "*localization*". Swyngedouw (2004) argues that glocalization is an approach to rescuing inclusive view of globalization from the longstanding Western orthodoxy that often uses an exclusive lens to insert strategically its worldview in the name of universalisation. Similarly, Kloos (2000) express that glocalization represents a continuous interplay and interactive between globalization and localization (sic), thereby offering a perspective that both globalization and localization are inseparable aspects of the same phenomenon (as cited by Luitel, 2009, p.334). By this conception, we can say

that glocal knowledge is essential in classroom teaching and learning process. It empowers the learners. Luitel(2009) generates five empowering features of glocalization which are : a) glocalization can be regarded as an expression of dialectical relationship between local and global practices, b) it can be used to construct spaces called *glocals* which have the potential to generate empowering synergies between localization and globalization (Doherty, 2008, Gunnlaugson,2004), c) it is likely to help us contest any form of hegemony prevalent in mathematics teacher education , d) glocalization possibly offers an inclusive and agentic vision for teachers and teacher educators to think and act creativity , and e) it can help preserve and promote a positive image of *glocalization as conversation* (Henry , 1999). Furthermore, he believes that glocalization can offer inclusive and agentic visions for teachers and teacher educators so as to incorporate knowledge systems and wisdoms arising from local cultural practices. In my view, glocalization empowers to prepare the student to be good citizens to change the society.

Knowingly and unknowingly, I have been teaching mathematics since 1997 A.D. As a researcher I have to focus to explore on my study. So in this section, I will be presenting my lived experiences which I gained while attempting to incorporate glocal knowledge with pure mathematics. Furthermore, in this chapter, I present the learning experiences of students towards the use of local mathematics “knowledge”.

Episode-1

More meaningless and no punishment, mathematics is everything.

On 21August 2012, it was the evening time at 5.00 PM, some teachers were preparing the result of first terminal examination. I was busy doing my work in the office. Even though I was doing office work, my mind was more concerned with my thesis. According to my facilitator/ Professor, each student of fourth semester students had to submit at least five stories related to the research questions. So, while walking, my mind diverted to the type of story that could be considered. I remembered the experience of mathematics of passed time. While I was staying at the office, three teachers came to my room and mentioned that they were very hungry. When I ordered for them, I got a chance to talk about my study. I asked to one teacher about mathematics.

According to her, she believes that mathematics is considered as a subject of calculation. If a person knows to add and subtract between things, money etc., then it is assumed that this person is familiar with the area of mathematics. The rules, theorems of mathematics are mostly used by everyone; knowingly and unknowingly in their daily life. It is applicable everywhere. So it can be said that no one can survive ignoring the concepts of mathematics. Moreover, she remembers, mathematics means measurement and it brings accuracy in transaction

Figure 14: Mandap/ Mandala

I really believe what she defined is true. It is indeed used in every step of life. The rules and theorems are mostly related to our daily lives. The Pythagoras theorems which can be taught in the school mathematics are always used by masons and carpenters to make squares. I remember the day when my friends were preparing the mandap [12](Mandala) on the occasion of New Year of Nepal sambat (Newari culture) or Tihar[13] (second greatest festival of Nepali people); they were unsure about how to make the square for mandap. They had called me to ask. When I got there after 30 minutes, a carpenter had already started preparing a square. I tried to see how he did it and realized that he was applying the Pythagoras theorem. Actually, he has no formal education he has only passed 4 or 5 grade. However, the Pythagoras theorem is taught in grade 8. So we can say that the school mathematics and day to day mathematics can be connected.

After that I say to her," Can you please tell me about how you felt about learning mathematics.' To this she says to me that in the beginning of her schooling days, she did not like mathematics subjects because for her, in those days mathematics meant hard subject which was nothing more than memorizing and memorizing every time. Most of her friends thought it was a punishment. It was because they could not memorize what they had studied.

While she is saying this to me I remember the argument of Zaslavsky. According to him, "Many people think of mathematics as a punishment or something that induces stress (Zaslavsky, 1994)." In the same way, I also used to take mathematics as a punishment when I was a child and some of my students also take

[12] Mandala (Sanskrit: मण्डल *Mandala, "*circle") is a spiritual and ritual symbol in Hinduism and Buddhism, representing the Universe. The basic form of most mandalas is a square with four gates containing a circle with center point.

[13]Tihar (Nepali: तिहार) is also known as dipawali, is a five day long Hindu and Buddhist festival celebrated in Nepal which comes soon after Dashain. In newari culture, it is known as Swanti. In this festival, goddess Laxmi is worshiped and bothers are worshiped for their long life.

me as a punishment teacher because I am their mathematics teacher, I also give punishment to the students in my beginning classes.

Moreover, she expresses that the way of teaching was just a description method when she was studying at school level. The teachers only taught the content in the mathematics books and did not attempt to link mathematics with our everyday life. No more additional taste is there on the teaching methodology. So, that she was not too eager to learn mathematics at that time and the days passed, she has experienced different forms formative and theorems of mathematics.

To give meaningful learning, we have to take students to our favor. For this, first of all we have to change our teaching methods. But this change can be very difficult. Just like if we were to eat meat only every day, we don't like it if the teaching method is guided by traditional methods only, this has to change. Otherwise, we will not be working in favor of the students, and hence teaching learning activity is not so meaningful.

Again she adds that when she reached grade 6; she got an opportunity to learn mathematics from a very talented and brilliant teacher. He managed to teach very effectively. He always used everyday materials in mathematics teaching. Before doing the exercises of any chapter, the teacher linked the relation of the content with our daily life. For example, while teaching profit and loss, he gave an example of a shopkeeper selling 1 kg of potato, selling a ropanee of land; selling grains etc. these things are related to our day to day lives.

So, that's when she realized mathematics is a vast subject and there are many things to be learnt and she argues that it is a day to day mathematics. I recall Luitel (2009) mentions that mathematics lives in various day to day works, embedded and embodied in the society as cultural practices. Actually, she has followed Luitel (2009)

beliefs and I fully support both of them. That's when she finally found a new way of learning mathematics. The teacher introduced many practical ways for teaching her. Sometime he used to play cards, chart paper and any other materials for making his students comfortable in learning mathematics and sometimes he gives his students a project work about the materials uses at home. Sometimes he was rude and sometime friendly. So that way he was able to make his students excellent in mathematics just like him.

And moreover, talking with her, I found out that she stopped going to her extra tuition classes for the first time in grade 6 after she got the opportunity to study compulsory mathematics with her favorite teacher. I was eager to know the reason of leaving her extra tuition class. So I asked to her, "Why do you leave the tuition class?" she replied to me, "It is because the tuition class teacher only focused on our homework. The teacher didn't know the application of mathematics. According to him, mathematics is only calculation nothing more than that."

The use of everyday materials in mathematics changes students' behavior. Students learn more mathematics and more eager to learn mathematics with more practical examples that they can apply to their life. Moreover, they start thinking about mathematics at home while cooking rice, buying groceries, working in their land, watching T.V, music players, refrigerator, playing marbles with their friends, playing cards, etc.

I asked her," what are you doing now?" she replied," I am now also following on my teacher's footsteps. I was always influenced by his way of teaching. So every day, I try to relate daily mathematics with school mathematics. So when teaching geometry, first of all, I give examples of different shapes of materials used at home. Also I ask the students, and the students are very keen to give examples of materials

used at their home. While teaching mensuration to grade 9 students, I give examples of cylinder as drum, pipe, pencils, bottle, chimney, etc. also they give examples of prism as stairs used at their home, rooms, houses, roof of their home etc. In this way, while teaching mensuration at class, the students are very interested and they are eager to read and solve the problems. That means they are taking very easy steps to study mathematics." finally I asked her, "How do you feel using or relating school mathematics with daily life mathematics?" For this question, she answered me," Mathematics is a practical subject. It should be always linked with practical daily lives to be taught and learnt."

The impact of learning mathematics using or relating every day materials is positive for students. Only solving the problem of the textbook is not enough for the students. These students are from different cultures and society. They have to face many problems in society. As educators we have to solve these problems. At this stage, the mathematical concept helps to the student in solving. Every person uses mathematics in their everyday life decision making. It is used widely in everyday life in traffic investigations. Like in traffic investigation, we have to use mathematics every day. So for effective learning of mathematics, the methods has to be as good as the contents and it is through this teaching methods only that it is possible to make this subject more interesting and useful.

Episode-2

VAT in Mathematics

It can be any day of 2012, at 10:55 am; I have to teach the students of grade 10. I had asked my students to bring different types of bills because I am planning to teach them value added tax. It is about 10:59 am. I enter the classroom and all the students say (together)," Good morning, sir". I also say, "good morning everybody!

Take your seat." First of all, I look at all the faces of my students. This is my regular activity. I always do this because I want to know how my students are feeling by watching their faces and also to know whether all the students are ready to learn the mathematics or not. I always ask to my students, "How are you? It's all right or not." One of my students, Rabina looked very sad. So I asked her," What happen to you? Do you have any problem?" She replies," no sir" I say," it's ok. "Then, I write the chapter name on the white Board and say to the students," Today, we are going to study about the value added tax. Yesterday, I asked you to bring any bills that you have in your home. Have you brought the bills or not? "Sagar Rai says to me," yes sir. I have brought a bill. Please take it." I look at the bill and ask him, "What do you see in this bill?" He replies to me, "There is total bill of internet charge is Rs.1017 with VAT Rs.117." He is right. I write the amount of the bill on the board Rs. 900 and its VAT Rs.117. I ask the students again, "The total amount of telephone call is Rs. 900 but the amount received is Rs. 1017. Why is it?" One student named Shikhaa raises her hand and says, "Rs.117 is added to Rs.900.Rs. 117 may be VAT amount sir." I am very happy with her because she is getting the knowledge of what I am about to teach them. Again I say to them, "Listen my students, Shikhaa is right. Actually, Rs. 117 is VAT .Its meaning is value added tax." Again I ask the students," do you know, why is it added to the bill amount? All the students are silent about the question. So, immediately I say to the students," VAT is added to the bill amount because it is the amount to pay to the government as service charge which is used on the welfare of the country." All the students show curiosity to learn about what I am about to teach them. So I want to give another

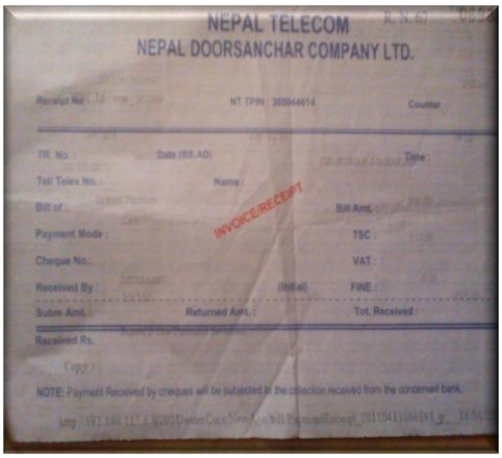

NEPAL TELECOM
NEPAL DOORSANCHAR COMPANY LTD.
INVOICE/RECEIPT

Figure 15: Bill of telephone

example of that kind of bill. But no other student had brought any bills. So I showed them a bill which I had brought from the account room. It is the bill of cement which was bought by our school for the construction work of the new building.

In this kind of class, all the students are actively participating in the classroom discussion. The students feel that they are learning their own mathematics. The mathematics is not only related to the text book, it is related to our day to day life. Therefore we can examine how mathematics is linked with cultures and how mathematics differs from culture to culture (Hammond, 2000). In the context of Nepal, there is lack of use or such kind of linkages to our cultural or day to day life mathematics. Most teachers argue that mathematics is pure and absolute. Because of this, we can see low performance in mathematics. So, mathematics is also impure. According to the fallibility beliefs, mathematics is incomplete and everlasting "work-in- progress". Likewise, mathematics is changeable, revisable and corrigible with new mathematics. Mathematics will differ according to different society. So, the teachers should teach mathematics relating to day to day life materials. It should not only focus exclusively of mathematics taught in school. It should be connecting the mathematics of day to day life and our cultures so that the students can make the process of learning mathematics meaningful. This perception is correct as per Luitel. According to Luitel (2009) mathematics is not only brought in from foreign countries, it is also practiced in our society. So, the mathematics should be taught by connecting the society.

Episode -3

Actually we learn through glocal activities

It can be any day of 2013. I am teaching to grade 10 students VAT. This time, I focused on writing the formulae related to VAT. I had written the formulae related to the topic as given below:

Discount amount= Discount % of M.P

Price after the discount = M.P –discount

VAT amount = VAT % of Price after the discount

Value of object with VAT= Price after the discount+ VAT amount.

After that I had generated one question relating to VAT as "The marked price of a watch was Rs. 4200. What will be the selling price of the watch, if 10% VAT was levied, after allowing 10 % discount on it? For solution of this question, I followed three ways as given below:

First method:

Here given, M.P = Rs. 4200

Discount= 10%

VAT = 10 %

S.P. with VAT =?

Now, we have, discount= 10% of Rs.4200

$$= \frac{10}{100} \times 4200 = Rs.420$$

Price after allowing discount = Rs.4200- Rs.420 = Rs.3780

Again, amount of VAT = 10% of Rs. 3780

$$= \frac{10}{100} \times Rs.3780 = Rs.378$$

S.P with VAT = Rs.3780 +Rs. 378 = Rs.4158 ans.

Some students were left confused after the solution of the given question was written. So, I decided to solve the question by another method, feeling that the earlier solution was so long which was given below:

Since, 10 % was allowed as discount, hence the S.P after allowing 10% discount = 90% of 4200

$$= \frac{90}{100} \times 4200 = Rs.3780$$

Also, S.P with VAT 10% = 110% of Rs. 3780 =Rs. 4158 ans.

The students were very happy with this solution. They felt that this solution was better than earlier one it was very short and easy to understand. Again, I wanted to solve the question by another method. So, I solved the question as

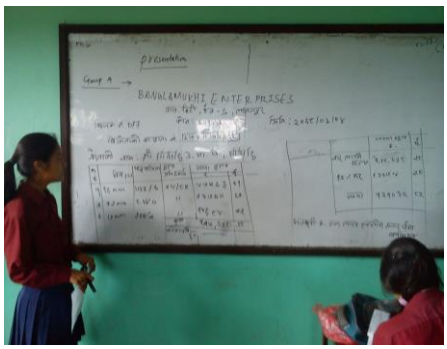
S.P with VAT = M.P (1-d %)(1+VAT %)

$$= 4200(1-10\%)(1+10\%)$$

$$= 4200(1-\frac{10}{100})(1+\frac{10}{100})$$
$$= 4200(1-0.1)(1+0.1)$$
$$= 4200(0.9)(1.1)$$
$$= Rs.4158 ans.$$

Watching this solution, all the students felt that this one was also very short. One of the students named Sujita said," the second and third method is very easy to understand. We will follow any one of these methods." I said to them, "it's ok. But best one is first method and then second method. The third one is only for rote learners. You can use any one of the method but your confidence makes a vital role." They all were satisfied with me and were ready to solve all the questions in the text book. After that the time was finished. So, I leaved the class saying, "Tomorrow, we will discuss about this again."

The next day in the morning, as a researcher, I wanted to study about the incorporation of glocal knowledge with school mathematics. So, I decided to use local knowledge to the students in mathematics. For this, I collected some bills related to VAT. I entered into the class room and asked to the students, they were seating in their own group. Most of the students were there as I needed. First of all, I divided different bills to six groups and gave 10 minutes to observe the bills in group. Each group had to present one by one. The students actively participated in this activity. After 10 minutes, they were ready to present.



First of all, Sujita from group A came to the front of the class room. She described the bill of rods bought by Harisiddhi School from Banglamukhi enterprises. She said," From, todays activity, we learn VAT clearly. Yesterday, we learnt only how can we solve the question related to VAT. But today, we learnt it by using a practical example and we can use this and follow in future. That means we are able to solve the problems related to VAT. Or we can use VAT in our daily life." After finishing her presentation, remaining group also presented actively and all groups were positive to first group and all the students said," we actually learnt today."

In the beginning students believed that mathematics problems can be solved by using different formula only. They were happy with different methods of solving .but some students were not able to understand with solution. So I decided to use or connect the local knowledge in the class. Students were learning when different bills included VAT were in their hands. They discussed about the bill amount and its VAT amount. They compared with earlier class and came o know that they learnt

practically and felt that it was very necessary in life. By their feeling, I came to remember to Blackmore (1999, as cited in Yi Tien, C. & Tally, P.C, 2012) that localization is a valid response; the aspects of what constitutes global and local should be viewed as different characteristics of the same phenomenon. Similarly, in relation to the effects of the globalization phenomena on educational concepts, schrottner (2011, as cited in Yi Tien, C. & Tally, P.C, 2012) expresses that "both the volume and the speed of global flow have intensified the entanglement of the local and the global, thus many local developments have enormous global consequences and vice versa" (p.51).

Episode -4

Collaborative competition

It is the year of 2002; I was a teacher in a popular government school. In the beginning of teaching, I used to teach the students only optional [14]mathematics. While teaching optional mathematics, most of students wanted me as their compulsory mathematics teacher because they were not satisfied with their math teacher of my school. Although the compulsory math teacher was brilliant and could solve all the problems of the book, they were not satisfied with him because he used to focus on only course books and rote learning. They mentioned to me that all the formulae of mensuration chapter of grade 9 had to be memorized; otherwise they would fail in the exam. According to these students, they had to memorize everything that was taught by him. They did not know about how the formulae were developed. So, their perception towards mathematics was a rote learning only and a very difficult subject. I was also told that they had gotten a chance to participate in competition,"

[14] Optional mathematics- In current Nepali school system students of grade 9and 10 can select any subject as optional subject. Mathematics is one of the subjects which are selected by those students who are talented to learn more knowledge in mathematics.

presentation of educational materials in mathematics teaching" which was organized by SEDU at V.S Niketan, Kathmandu, Nepal. Different materials as prisms, pyramids, cone, cylinder, etc which were made up of wood, ply board, paper, juice pipe etc were in the presentation. However, everything was made by the teacher and not by students. The students were confused to how they should be presenting those materials. They faced that one of the external, questioned them about the practical use of the materials; they found it too difficult to answer. At that time I was there trying to support them. So they gave answer hardly. As a result, they were unable to be first in that competition.

When the same students reached grade 10, they had to study compulsory mathematics taught by the same teacher. They requested me to teach compulsory mathematics instead. So, I started to teach them in a coaching class. I knew how the students felt about Mathematics. So, I decided to teach them effectively so that they would feel that mathematics is not very difficult, it is actually related to our daily life. In every chapter, I tried to focus on the practical side in the class. While teaching mensuration chapter, all the students were engaged in group work making cylinder,

<u>Understand the mathematics</u>

Do the mathematics

Remember the mathematics

Don't do the mathematics

Forget the mathematics

So,

Always practice the mathematics

And, understand the mathematics.

Always incorporate the local mathematics

And, understand the mathematics.

cone, pyramid, cube, cuboids etc using card board paper and scissors. After preparing the materials, we discussed about the shape of those materials and compared with local materials. Also, we discussed the formulae related to the mensuration using the materials. All the students were very happy with me that they knew the formulae of mensuration using and relating local materials easily.

After 6 months, they got an opportunity to take part in another mathematics quiz contest organized by ECC, at one of the popular and old government school situated in Patan. They were confident with that program because they felt at ease on that quiz. Most of the questions were related to mensuration chapter. They gave correct answers of questions whereas others could not give the answers. As a result they won the quiz contest and won a first prize and all the teachers who were there in the quiz contest felt that the students of Harisiddhi School were very talented. They got such kind of opportunity because they were guided practically in the classroom. All the formula related to mensuration chapter and geometry was taught with educational materials. They were able to connect those materials to their local materials such as cone as ice cream, birthday cap etc, cylinder as drum, pipe etc. By using the knowledge of local materials they were actively participating in formation of different formula. For example:

Circle board

The Circle Board is made from using local materials. It is constructed by using 26cm×26cm ×1cm ply wood, some pieces of pins or nails, and a 20cm×20 cm ×1cm graph. With the help of this circle board, students can learn different geometrical concept such as radius, center,

Figure 17: Circle Board/ Ratio Board

diameter, arc, circumference, chord, circumference angle, central angle etc. Likewise, using this circle board, it is easy to understand the concepts of different geometrical theorems related to circle. Circle board is also known as sine /cosine computer. By this students easily understand or find the value of different trigonometrically values of sine and cosine from 0^0 to 360^0.

Geo-board

The Geo-board is also made using local materials. It is constructed using a 36cm×3cm×1cm ply wood, some pieces of pins or nails which are locally found. By the help of this material and rubber bands students can learn different types of geometrical shapes as triangle, quadrilateral, pentagon and other polygons. Likewise, from this board, the concept of L.C.M (Lowest Common Multiple) and H.C.F. (Highest Common Factor) is easily understood by the students. Different types of geometrical theorems and the transformation concept are practically shown by this board.

Figure 18: Geo-Board

Volume of cylinder

For the concept of the volume of cylinder, I usually use a structure made from paper. Firstly, using some pieces of small triangular pyramids which are all equal, I prepare a cylinder shape. Then students can easily compare it with a drum,

Figure 19: cylindrical form

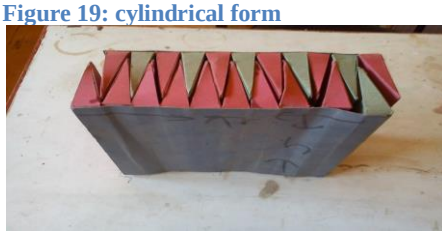


Figure 20: cuboid

or a pipe as local material. They would know the height, base of that cylinder. When the cylinder is changed into cuboids as shown in the figure, then they are introduced that the volume of cylinder is equal to the volume of cuboids.

i.e. the volume of the cuboid

$$= lenght \times breadht \times height$$
$$= \pi r \times radius \times height$$
$$= \pi r \times r \times h$$
$$= \pi r^2 h$$

In this episode, I want to explore about the changes in learning experience. The students express interests towards the use of local math (knowledge, materials). In the first condition, they are faced with lack of practical interest. They are only focused on technical interest. So that they think that mathematics is only memorization subject. It is a collection of only formulae. In the second condition, they face practical aspects of mathematics in their class. They focus on practical interest, emancipator interest and technical interest. So, they can easily understand the mathematical concept. Similarly, if there is an opportunity of relating school mathematics with local knowledge, the students can learn mathematics more actively. It means, there should be use of local knowledge in mathematics classroom. Promoting a dialogue between the local and global dimensions allow the setting of a bridge benefiting the development of both mathematical dimensions (Latas, 2011, Moreira, 2007, 2008). So, most of the time, while teaching mathematics especially about mensuration and geometry, I used to construct locally available materials and then compared with local material. These kinds of activities help students to take interest in learning mathematics. In fact, in a local dimension, the activities which young people, driven by their interests and curiosity, develop during their daily life, allow them to develop mathematical skills and informal knowledge which hold a

strong potential for establishing connections with the mathematics in a school context (Boavida, Paiva& Pimentel, 2008), that is, develop a spontaneous mathematicization in an out of school context, in the words of D'Ambrosio's (2001) quoted by Gerdes (2007).

Episode -5

Pyramids as local context

It could be any day in2012, some students were running around in the school ground and some were playing football. When I reached the school, I didn't say anything to the students because I was running late. The students of the grade 10 went to their classroom and remaining students still were playing. Taking some materials, I entered to the grade 10. All the students said, "Good morning sir!" I also said, "good morning my students. Have a seat." First of all, I asked to the students, "Why are you playing outside? You are going to attempt the SLC exam this year. Why are not you serious about your studies?" one of the students named Sarnia said, "Our teacher didn't come. It's very cold today. So we all decided to play. Sorry sir. We won't do it again." "It's ok." I said to the student (knowing their problems) and then I was ready to teach them. First of all I said to them," have you sat all in your group? I mean you all are in seating group? "They all replied," yes, we are." (Immediately) I said, "Ok."

Figure 21: Trisakti Bhagwani Temple

"Today, we are going to learn more about different pyramids which we already studied yesterday." The students were curiously looking at the objects which were on my hands and listening very intently. I distributed juice pipes and thread to each group and informed that each group had to prepare one pyramid as triangle based pyramid, square based pyramid, rectangular based pyramid, pentagonal based pyramid, and hexagonal based pyramid by using pipes and thread. All the participants were very busy on making different pyramids. I gave advice when they needed or they were stuck on something. At the end they finished the work that I had given them to do. They were very happy to see the pyramids they had prepared. After that each group presented about their pyramids. While doing the presentation, one leader of a group said, "Yesterday, we only learned the definition of pyramids. Sir had written the figure of pyramid on white board which was seen only in two dimensions. It was very difficult to understand the concept about pyramids that way. We were confused about the height of pyramid and slant height of pyramid. But today, we actually learnt about pyramids. We used to think of pyramids only about the material which is used in science while learning the light chapter. Today we learnt that we can make the pyramids by using straw or juice pipes and can compare it with roofs of building, roofs of temple etc." by listening to his presentation, I was very much satisfied with him and added , " the pyramid is a three dimensional solid object . We can see only two dimensional in figures. We can compare the pyramids with our local context. The roof of the temple, roof of the building are the example of different pyramids shaped used in everyday life. It is very important to us." After that all the students felt very happy in this kind of class. The bell rang and I left the class saying," write the list of pyramids used in local area and thank you all students for active participation in today's class. Have a nice day."

The episode which I generated in my study focuses on the importance of learning mathematics by constructivist approach. The students could easily learn mathematics by constructing pyramids. They could compare the pyramids with things they have been seen or observed. The students can better remember the materials if they make or touch it themselves. So learning by doing (Schneider, 2000) is very important theory for every mathematics teacher and students. According to Vygostsky (1986, as cited in Sharma, 2012, p.24), learners first construct knowledge in their interactions with people and activity contexts. By this perspective, we can say that knowledge and learning are considered as social activities which are developed by cultural resources. The above episode also explores the social activities. They are able to compare the pyramids with the roof of temples, roof of their buildings etc. This activity also describes the ways in which power, economy and social factors affect the ways in which groups of people develop understanding and formal knowledge about the world. As mentioned by Sharma (2012), Von Glasersfeld states , " knowledge is the result of an individual's subjective constructive activity , not a commodity that somehow resides outside the knower and can conveyed or instilled by diligent

Figure 22: students making pyramids using juice pipes

Figure 23: students making pyramids using juice pipes

perception or linguistics" (p.2).

Episoide-6

Area of four walls

It could be any day in August, 2012. It was raining outside which made me very lazy. I felt cold and wanted to stay in my office room. It was time to go to grade 9 to take the class. Although the environment didn't support, I entered the classroom although tired and lazy, I began the class. The topic was the mensuration. The day before, I had taught them the basic concept of this subject. That day I was going to teach the students about an area of four walls. The students had already learnt this topic when they were in grade 8. Assuming that the students were already familiar with this topic, I wrote the formulae of area of four walls, area of four walls excluding door and windows on the board I solved the different types of problems relating to area of four walls using formulae. One of the students asked me when he was doing the class work about finding an area of four walls without the area of door and window. Some other students faced the same problem.

Bijay (first boy): Dil sir, I am unsure how to find an area of four walls of a room excluding a door and two windows.

Me: Thank you, Bijay. It's good. You ask question for solving the problem. Keep it always. And listen all my students, if you have any problem on learning, you may ask the question. Don't be shy.

Nagima (a girl student): sir, I am also confused. Please teach me how can we solve this problem?

Rabina (a brilliant student): sir, I am confused about subtracting the area of door and window. Why are we doing so?

Sanju (poor in mathematics): sir, why are we adding the area of floor and ceiling?

Me (listening carefully the questions of students, I try to convince them): When finding an area of four walls excluding a door and two windows, including floor and ceiling, first of all , imagine you are in this room (classroom) with a door, two windows, floor and ceiling. Do you understand my students?

Bijay: it's ok. Then, what do we do?

Me: you can see that there is no wall at the place of door and windows.

Nagima: yes sir. There is no wall in the place of windows and a door. Sir, this is the reason to subtract the area of door and windows from the area of four walls.

Me: Nagima, you are absolutely right. So my students, all of you know that we can see four walls in a rectangular based room, we all are staying in this kind of room, its total area

$= l \times h + l \times h + b \times h + b \times h = 2\, l \times h + 2b \times h = 2h\,(l + b)$

Sanju: is it the area of four walls?

Me: Yes. You got the point. Also, you can see some parts of walls are occupied by a door and two windows which are to be subtracted. Do you get the point?

Nagima: Yes, sir.

Me: So, the area of the four walls of a rectangular room excluding a door and two windows

= 2h (l +b) - (area of a door and area of two windows)

Bijay: the area of door = a×b (say) where a = width of door and b= height of door. Is it correct sir?

Me: sure. Bijay is right. Similarly, you can find the area of a window?

Meera (next student): the area of two windows = 2 (area of a window) = 2xy where x=width of window and y = height of window. Is it sir?

I: yes. Now, Bijay, can you say the area of four walls excluding a door and two windows?

Bijay: its area = 2h (l +b) - (a×b +2xy)

Me: wonderful. Now you all can solve this kind of problem. Similarly, if we have to find the area of four walls excluding a door and two windows and including a floor and ceiling, we can use the following formula:

A =2h (l +b) - (area of a door and area of two windows) + area of floor + area of ceiling

A =2h (l +b) - (a×b +2xy) + a×b +a×b

A =2h (l +b) - (a×b +2xy) +2 a×b

Students, Bijay, Sanju, Meera, Nagima and others students (together): Yes sir. We know

Let's encourage me as a mathematics teacher

To speak from my heart

To tell the truth of whom I am

To allow them to explore their identity

To link between the world and the world

Let's encourage me as a mathematics teacher

To know what I don't know

To admit what I don't admit

To share what I don't share

To realize what I can and cannot know

Let's encourage me as a mathematics teacher

To treat my students as human beings

To regard my students as self –ful persons

To fulfill a yearning for knowing, being and valuing

To see hopes and possibilities in every students

Luitel & Taylor (2008)

the formula meaningfully. Now we can solve all the problems related to these kinds of questions.

Me: Thank you my students. I think you can now solve all the problems. In today's class, you all incorporated local knowledge with pure mathematics and you understood the problem. So while doing the mathematics, you need to incorporate the problems from our real lives so that you can make it more meaningful.

All students: "Thank you sir. We will do so."

From the above episode, I felt that when the students are taught by incorporating the local knowledge in mathematics, they can easily understand the concept. The meaningful learning occurred when the students are " explicitly taught how to use the psychological tools of their culture (like language, mathematics, diagrams, and approaches to problem solving) and are then given the opportunity to use these tools to create a common , or shared , understanding of some phenomenon". Similarly, I agree with Pandey(2010,p.71) that the aim of a teacher needs to be not only to complete the course as given in the course book but to make their students to understand what they are learning and to provide the opportunity to learn. Moreover, Marta Civil has cited (Mathematics teaching and learning of immigrant students, p.6) that if teachers are not aware of children's mental calculation processes and do not use them to know more about the role of local mathematics in mathematical knowledge in contemporary society, a good opportunity to educate the citizens of the world is lost (Moreira, p.1594) .Furthermore, Anastasiadou (2008, as cited in Marta civil,2008) writes, the de facto multiculturalism (…) which now describes the Greek society,… [Which] continues to function with the logic of assimilation (…).In the field of education the adoption of the policy of assimilation means it continues to have a monolingual and monoculture approach in order that every pupil is helped to acquire

competence in the dominant language and dominant culture(p.2) So, in my view, the teaching profession is not only to teach the contents of text books and complete the course but also to ensure that the students are able to incorporate the local knowledge so that they can learn meaningfully. Furthermore, Ernest (as cited in Sandit, 2007, p.344), "knowledge of mathematics is transformed by means of practical of mathematics teaching (both pedagogical and curricular) into representation for the classroom use of content knowledge." In the above episode, the students are able to better understand the area of four walls excluding a door, two windows and including the floor and ceiling when they are taught by practical concept in the classroom. They are able to solve the problems when they can connect the content with their everyday life.

Chapter summary

In this chapter, I have presented some of my experiences of teaching process in the classroom. I crossed a long bridge from informal teaching to formal teaching. Similarly, I changed my teaching method from traditional to a new pedagogy. The impact of the teaching process shows the change in learning process by the experiences of the students. Also it shows the education in learning by doing and active participation of students in the class room means the students are learning meaningfully. By hook or crook, if he/she is engaging on relating the pure mathematics with glocal mathematics, he/she is learning something. In this way, I wanted to explore my experiences about incorporation of glocal knowledge with school mathematics. For this, I have crossed many bridges as untrained teacher to trained teacher, informal teacher to formal teacher, one way teacher to multiple teachers, teacher centered to students centered and so on. But it is difficult to work. Thus, this chapter shows my journey of teaching life from easy to difficult. I agree

with Sharma (2012, p.138) that less knowledge less problems and more knowledge more problems. In the beginning, I think mathematics learning is only the calculation of mathematics as narrow sense but now I think it is not only in narrow sense, it is world and all my organs are now always looking for new teaching process so that the students can learn and do meaningful mathematics as teacher and researcher.

CHAPTER VI

GLOCAL KNOWLEDGE EMPOWERS LEARNERS

Mathematical imagination and imaginary, closely linked, provide the vision that allows us to see the hidden but exquisite structure below the surface.

- Robert Osserman (1995)

Overview of the chapter

In this chapter, I am going to explore the meaning of empowerment in the teaching and learning of mathematics. We know that mathematics is a powerful knowledge in our society. The person who has good knowledge of mathematics can solve any problem of his /her society .The society depends upon mathematics. Human beings are developed by mathematics. Also it is a basic tool of communication. In daily communication, it involves frequent use of its concepts. So it is important to improve the access for as many students as possible to a quality mathematics education so that the students get empowered. In fact, the empowerment is the gaining of power in particular domains of activity by individuals or groups and the process of giving power to them, or process that foster and facilitate their taking of power (Paul Ernest, 2002). Actually the mathematics has power and it can empower those students, teachers or learners who acquire it. In this point of view, the mathematics is very powerful and glocal knowledge empowers the learners. So I am going to elaborate about this in the chapter.

The mathematics education gives “power” to a person because it gives the students mathematical skills that are of paramount importance in current social process. Valero (2007) argues that the power of mathematics and mathematics

education is also brought in relation to a person's participation in a global economy. Furthermore, he explores that powerful mathematical ideas are those that will allow people to think in ways that secure their success as working force in the 21st century, that is, in the global economy. In fact, the empowerment is learning process which we can create to the students in mathematics teaching because mathematics has power to think about lived experience of day to day life. Lather (1991) defined empowerment as the ability perform a critical analysis regarding the causes of powerlessness, and ability to act as a single subject, group ,or both to effect change toward social justice. So, it should be given to the students so that they can learn mathematics easily. Similarly, I support Valero (2007) that mathematics education as practices are not restricted to the sphere of the classroom, but transcended it by including the practices of different social actors and institutions, and the interconnection between those across levels (p.3). Moreover, we are not only concentrating on text books but also connecting it with social relations and culture. The "uses of mathematics" here do not only refer to the concrete applications of mathematics in the development of technological devices as Skovsmose (1994) emphasizes but also the 'functionality ' that people give to it in the construction of social relations and culture.

Episode -1

Ptolemy's theorem as memory

It could have been April/May in 1995; I was a student of grade 10. Being the first boy of the class, I always taught my classmates. I could solve all the problems of geometry whereas my friends would struggle. They felt geometry was very difficult and often said, "How can Dil solve all the problems? Dil is very generous and hard working?" The time went by, one day, our mathematics teacher was absent. So, we had free time and as usual my friends came near me and asked, "Can you teach us

Ptolemy's theorem? We have no idea on how to solve it." I could not dismiss their request. So I was ready to teach them. I taught them about the Ptolemy's theorem what I had learnt by my teacher or what I understood. They were confused by the proof. I tried to share the knowledge but they were still confused. So I said to them, "we will discuss this meaningfully tomorrow. I will ask this problem in our class. Our teacher will solve our problem." They all accepted and were ready to take the next class.

Next day at sixth period, our mathematics teacher, Thomsen (name changed) came to our class. We said, "Good afternoon sir!" Thomsen also said (hardly) "good afternoon students! Sit down!" Before he began to teach, I asked (being afraid) to my sir, "yesterday, we practiced about the Ptolemy's theorem. But we were confused about the theorem. So please revise it again sir. ", he answered, "ok. Open your book page no-48." He, Thomsen taught us the same proof that was there in the text book. We were still confused by the proof. So, I asked to Sir, "Can we prove it by giving meaningful examples. We all are confused by the reasons provided on the book." Thomsen, my teacher replied, "there is no another reason. This kind of theorem should be memorized. Otherwise, you cannot do it. Do you understand?" Mr. Thomsen's answer entered my ear as very narrow. I wanted learn the Ptolemy's theorem by understanding it because we, the students hadn't understood the theorem. My teacher tried to generalize that we had to memorize all the statements and reasons with figure which were given in the text book so that we can understand the theorem better.

The S.L.C. exam was coming closer. We had to attend the S.L.C. exam that year. We were the first batch of our school. So we all were very serious about this exam. We were taught by the teachers who were also new for exam. So the students as

well as teachers were doing their best on exam and we went to coaching class far away from our school for two months. We studied at school for day shift and then we went to take coaching class at evening shift. As a first boy of the class, I didn't need to study compulsory mathematics and other subject except the optional mathematics and science. I studied optional mathematics and science in coaching class because what we learnt in school, we were not satisfied with.. Specially, I wanted to score the more than 90 marks in the Exam. Mr. Gyawali used to teach optional mathematics at the coaching center. He taught Ptolemy's theorem with reason and meaningfully. We understood it finally. Before giving us the proof of this theorem, he tried to give the concept of the theorem. He demonstrated a material (quadrilateral) which was made up from four juice pipes and threads and also there were two diagonals of quadrilateral.

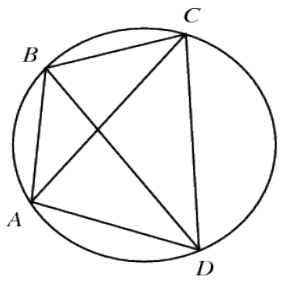


Figure 24: Geometrical figure of Ptolemy's theorem

The quadrilateral was pasted on a circle shaped ply wood as in the given figure. We were very excited that we were learning mathematics very well. By the help of measuring tape, Mr. Gyawali measured the length of sides and diagonals of cyclic quadrilateral ABCD and then showed the result as $AB \times CD + AD \times BC = AC \times BD$ *i.e. for a cyclic quadrilateral, the sum of the products of the two pairs of opposite sides equals the product of the diagonals. We got the concept of Ptolemy's theorem. Before learning this, we had the knowledge, but didn't know how to prove the theorem? Actually, we were able to have the concept and critically analysis the proof of the theorem.*

In this way, he taught most of the chapters very effectively with connecting it with day to day life scenarios. While teaching Pythagoras theorem in trigonometry, first he described the application of it as in engineering to find hypotenuse when the base and perpendicular are known. Similarly, he gave the concept of height of a temple, height of hill, building, chimney, pole while teaching height and distance in trigonometry. Moreover, he added that height and distance is also used by soldiers and engineers to find the distances. One activity, I will never forgot is the use of clinometers by which we found the actual height of school building. The teacher gave the environment to do such kind of activity which made us enjoy our learning. We understood the entire chapter because he used to incorporate local knowledge with the content in the text book. Those activities empowered us to learn mathematics easily.

These activities that Mr. Thomsen made us dislike mathematics and reached to consider, "why did I select optional mathematics?" perhaps, the predominance of mathematics, power of mathematics and teachers made me optional mathematics as additional mathematics. Ernest (2002) argued that success at mathematics gives students power through enhanced life changes in study, the world of work, and social affairs. That's why I selected the optional mathematics to learning mathematics. By the above episode, I tried to show the relation between teacher and student. In the first case, Mr. Thomsen did not want to share with examples. The teacher was bounded by only the content in the book. So in this condition, the students are confused while getting education. As Vygostsky (1978) asserts meaningful interaction happens when students interact in the language they are comfortable. So there must be interaction in the classroom while teaching and learning process is going on. In the second case, the teacher and student interacted with each other so the students could learn easily. Also,

the students felt more empowered to learn mathematics because the teacher, Mr. Gyawali created a kind of environment where the students compared the content with their day to day life scenarios. Ethno- mathematics does not study only the number systems and symbols of different ethnic groups but also the representational systems and mathematical knowledge (Luitel, 2007). Also Sharma has mentioned in his paper (2012) as local resource and local mathematical belief system are also valuable for contextual mathematics development stage. Furthermore, he argued in his paper that local learning materials helped him a lot in developing conceptual understanding of mathematics. Knowledge system are a set of responses that a group gives to its for survival and transcendences , inherent to the human species (D'Amboise , 2006) and linking of such knowledge system in education promotes the learner's day to day real life problem solving. This means local knowledge promotes the mathematics learning in the classroom and hence the ethno mathematics emphasizes the application of the Mathematics in the school. D' Ambrosio discusses about how culture plays an important role in development of mathematical knowledge. In my opinion, D' Ambrosio is very true about his perspectives regarding program ethno mathematics. This is because the inclusion of culture in mathematics does awaken the interests towards the reasons for learning school mathematics and bring out the mathematical talents of the students. This also encourages the students to explore the mathematics involved in different cultures and their approaches to different mathematical concepts which is more meaningful and relevant. The learners will be able to make important connections between in school and out of school mathematics and help those to find significant meanings too many abstract mathematical ideas taught in schools which would otherwise be difficult for students to learn and understand.

Episode –2

Egg and potato as oval

It could be morning of June in 2013, it was raining outside. The whole sky covered by clouds. The birds were flying around to flee cold. The water was falling from the roof of my old house. My mother was putting out pots to save the floor from flooding, crying and scolding me for not looking after of house. I was trying to convince to my mother that I could only manage after few months when I am less busy. My lovely son (4 years old, studying at L.K.G) was taking lunch. He loudly said, "Dady, daddy, look triangle." His mom and I went to near him and watch in the plate. We saw three chana[15] which was in a triangle shaped. He was very happy to see the triangle in the plate. We were very happy with our son. At that time, I felt that he had already learnt about the triangle in the classroom. So that he can easily recognize a triangle.

The next evening, I was busy working on my thesis. My son was doing his homework and his mum was helping with his homework. His teacher had assigned him to write and read A-apple, B-ball, and so on. My mind was moving away from my thesis when my son was trying to say O for oval. I wanted to incorporate local material at that time. So I and his mum said to him, "You go to upstairs and ask your uncle (a mathematics teacher of famous private school) and ask him for an oval. Ok my son!" He went and asked to his uncle, "Please, give me an oval." But his uncle didn't understand about his speech. Again and again he requested to give him an oval. At last, I tried to help to my brother, "you can give him an egg, an oval shaped object." My brother was shocked for a while that he did not think about the oval. Such a small children knew about the oval. After a while, he gave a small potato liked an

[15]Chickpea

oval to son and came to near. My son happily said, "Look, my uncle gave me a potato. Is it oval daddy? My madam says an egg is an oval." I replied, "Devin, my son! Potato is also oval. So your uncle gave you this." Then he was very happy and carried on with his homework.

He would be followed by incorporation of local knowledge. Furthermore, there should be such an environment in school or home that he can compare school mathematics with everyday examples. In my opinion, if all the content in the text book are taught by incorporation of local materials or knowledge, surely the learners can easily understand about the content and compare it with their everyday life materials. In the episode given above, my son already knew about the triangle in the class room. So when he was eating lunch at home, he noticed a triangle shaped three grains on the plate. This kind of activity encourages him to study mathematics. Paul Ernest has cited on his "philosophy of mathematics education journal 15, 2002 about "empowerment in mathematics education as "From a cognitive psychology perspective, mathematical empowerment concerns the 'acquisition' of the facts, skills, concepts and conceptual structures of mathematics, and the general strategies of problem solving. Furthermore, he argues that the successfully empowered learner should demonstrate an appropriate range of mathematical capabilities such as performing algorithm and procedures, computing solutions to exercises , solving problems , and so on. In my view, these kinds of cognitive capabilities play a vital role in learning mathematics and to achieve a well-defined outcome in mathematics learning.

In the second case, my son had learned about the oval in the school. He is only guided by technical interest. According to Harbermas, the technical interest gives rise to a certain form of action (instrument) which is governed by technical rules based

upon empirical knowledge (Grundy, 1987, p.12). This kind of interest will guide and promote the students' learning which is the positive reinforcement to lead the students' learning process. My son is also force to lead the concept of oval. While doing the homework at the home, he is totally followed by practical and emancipator interest. 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 (Harbermas, 1972, p. 310). While my son was taking potato as oval, we discussed and interacted with each other that it could be an oval. The practical interest is an interest in understanding the environment so that one is able to interact with it (Grundy, 1987).

Episode -3

Set in the classroom

It could be any day in November 2012, I was teaching to the grade 9 students. As a researcher, I always want to connect the content with local knowledge by telling a story related to the content which I am about to teach as well as demonstrating the materials in the classroom and field visits so that the students get ready to learn the content meaningfully. That day, I was teaching my students about verbal problems with two sets. It was difficult for me to teach without the concept of local knowledge. So I had created such environment that there would be active participation of student. The season was a winter and time to have long tour for grade 9.Every year, the school management (where I teach) organizes a long tour for grade 9 students. As a mathematics teacher, I had to teach them verbal problems of set and as an accountant, I had to find the number of students where they would like to go for tour

either Pokhara[16] or Lumbini[17]. So, I asked to the students, "the school management is going to organize a long tour for all students of grade 9 soon. Where do you want to go, Pokhara or Lumbini?" All the students felt very happy (listening my voice) and ready to answer. I had wrote on the white board as

No of students who liked Pokhara only=…

No of students who liked Lumbini only=…

No of students who liked both=…

No of students who don't like both=…

I requested to the students, "Please, tell me, one by one about this." Then the students were giving their voices one by one. I was writing tally (line) according to each student's answer. Some students liked only Pokhara, some liked only Lumbini, and some liked to both and so on. I kept all the records of where they wanted to go. We got the following result:

No of students who liked Pokhara only=22

No of students who liked Lumbini only=14

No of students who liked both=10

No of students who don't like both=9

Immediately I said, "Mandal (one of the student), stand up. How many students are here?"

He answered, "55, sir." Again, I asked to him, "how did you answer it?" he again said, "by counting the number of students here as well as adding the numbers that sir

[16]Pokhara is the largest city of Nepal after Kathmandu and Biratnagar, situated about 200km west of the capital Kathmandu. It is one of the most popular tourist destinations in Nepal.

[17]Lumbini is a Buddhist pilgrimage site in the Rupendehi district of Nepal. It is the place where Queen Mayadevi gave birth to Siddhartha Gautama who is known as "Lord Buddha". It is one of the world's great religious.

had written on whiteboard."I was satisfied with his answer and gave him a permission to sit down.

Again, I asked to one of the girl student, Dhamala, "Can you tell me the number of students who like to go to Pokhara?"

Dhamala (immediately): "yes Sir. It is 22."

I: "Yes, you are near to correct answer. Try again."

Dhamala: "but there are 22 on white board."

I: Yes, it is only the number of students who like Pokhara only. You have to say the total no of students who like to both Pokhara and Lumbini both."

Ghising (another brilliant student): "sir, I think, it is 32."

I (very happily): good, you are right. Can you describe how it is?

Ghising: "why not sir? The students who liked only Pokhara is 22 and the students who liked to both Pokhara and Lumbini are 10. The sum of 22 and 10 is 32. Total students who like Pokhara are 32. Am I right sir?"

I (pat on Ghising shoulder and shouts at others): (Loudly), did you understand?

Whole class (voice): yes sir.

I wrote one question on the white board and looked around the class. The question was below:

What is the number of students who like to go to Lumbini?

Me: who can answer this? Raise your hand.

Sujita (student): it is 24.

I (immediately): Right Sujita.

(The whole class is seemed very active. I think they are ready to learn. So I write a question related to above discussion as

"In grade 9, there are 55 students. Out of them, 22 students like Pokhara only, 10 students like both Pokhara and Lumbini, 9 students don't like both. (i) How many students like Lumbini only? (ii) Show all results in a Venn diagram." The students have already known about the formula related to set in earlier classes such as

$$n(A \cup B) = n(A) + n(B) - n(A \cap B)$$
$$n(U) = n_0(A) + n_0(B) + n(A \cap B) + n(\overline{AUB})$$

And so on.)So, I told them to compare the above question with the formula and think about the solution of the question. After a while,

I: who can solve it? Raise your hand. (Nobody raises their hands.)

I (shout): nobody! This all rubbish! I have already taught you about the formula related to this question and you don't know it? Try to link it with formula. (Looking 1st girl of the class named Sujita) ok, Sujita come here and solve it.

Sujita: ok sir.

She came and solved the question as below:

Solution: here given,

Total no. of students, $n(U) = 55$

No of students who liked only Pokhara, $n_0(P) = 22$

No of students, who liked both, $n(P \cap L) = 10$

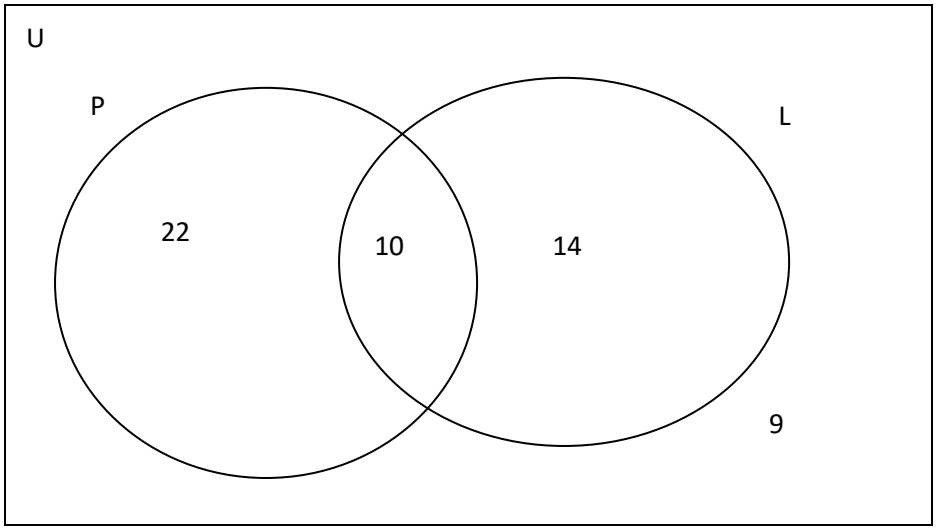
No of students who don't like both, $n(\overline{P \cup L}) = 9$

No of students who liked only Lumbini, $n_0(L) = ?$

Now, we have,

$$n(U) = n_0(P) + n_0(L) + n(P \cap L) + n(\overline{PUL})$$
$$55 = 22 + n_0(L) + 10 + 9$$
$$n_0(L) = 55 - 41 = 14 ans.$$

Venn diagram of above information is given below:



Hence, the number of students who like only Lumbini is 14.

I (giving thank to Sujita): very well done, Sujita. (Loudly), did you all my students understand the solution?

Whole class (one voice): yes sir.

One student (Mamata): it is very interesting sir. I understood.

After few months, the school management organized a long tour program for grade 9 and 10+2(higher level grade 11 and 12). There were two groups .Grade 9 had to go to Pokhara tour and the students of 10+2 had to go to Dolkha Bhimsen Mandir[18]and Tatopani[19]for long tour. As also a teacher of grade 12, I was selected on 10+2 group. At 9:00 am, we arrived at Kavre. All of the students were feeling very hungry and cold, and wanted to have a hot drink. So, we stopped at Kavre and went to a hotel for some hot drinks. There were different students. Some students were saying, "We like tea" and some students wanted to have biscuits and some liked to have both. Similarly, some students said, "Not like to both." It was difficult to find of number of tea, number of biscuits. So, I asked to the students to raise their hands those who liked

[18] The famous Bhimeshwar temple is located in Dolkha Bazar of Bhimeshwar. The main statue of this temple is god Bhim. Bhimsen of Bhimeshwar or Bhim of Dolkha and is noted as one of the most popular throughout the country Nepal.

[19]Tatopani is a village in Sindhupalchok district in the Bagmati zone of central Nepal. Historically and today, it is a huge trading post between Nepal and china.

to have tea, those who liked to have biscuits, and those who liked both and those who didn't like both. I got, 2 students wanted to have biscuits only, 2 students wanted to drink tea only, 27 wanted a drink and some biscuits and 1 student didn't like neither of them. Listening the students' voices, one of the teacher, ordered the tea as according to they said as following way:

No. of tea only=2

No. of biscuits only =2

No. of biscuits and tea=27

The shopkeeper was confused at first to how many cups of tea should be prepared and how many biscuits should be given? He recalled what the teacher saying and calculated as follows:

No. of tea = 2+27=29 cups

No of biscuits =2+27 packets=29 packets

According to this, he served tea and biscuits to students and teachers. After taking biscuits and tea, I went to the shopkeeper to pay. One of the students from grade 12 was near me. The shopkeeper calculated as following way:

	Number	*Price(Rs.)*	*Amount(Rs.)*
Tea	*29*	*15*	*435*
Biscuits	*29*	*10*	*290*
Total(Rs.)			*725*

His calculation was correct. So I paid according to him. But the student who was near me was confused with this calculation. He asked the shopkeeper, "Although there were 32 people in total, you calculated only for 29 only. Did you give us discount for 3 students?" the shopkeeper replied, "no. I had calculated all. Among 32, one student

had not taken anything and 2 students only had tea, 2 students only had biscuits and 27 had both. So, I gave only 29 packets of biscuits and 29 cups of tea." The student got surprise and asked me, "Sir, is this related to our topics…oh! Sir I forgot that chapter. Please can you tell me about the chapter?" immediately,

Me: "it is related to set chapter. You can draw the Venn diagram for this."

The student (showing the paper); is it correct?

Me (giving thanks): yes, you are right. We can connect school mathematics with our day to day life.

The student: I am very happy with this activity. I found the mathematics not only in the text book, it is everywhere.

Me: absolutely.

Later when the other students were coming near us, the student shared his experience about set chapter. Then they were also very fine. The horn of our bus was ringing. We stopped what we were talking about and got on the bus.

As a mathematics teacher, I think our responsibility, is not only to make students able to achieve good marks in examination so that school administration would be happy and we will be recognized as good teachers but also that students are able to apply the mathematics in their life. On the processor teaching and learning mathematics, students should feel empowered. If they are interested in learning, then the teacher should be able to mould them what the teacher wanted. So the role of the teacher is very important in teaching learning process. In the above episode, I have presented an experienced from my life which is related to motivate the students in the class room. Before introducing the chapter on Sets, the activity I presented in the above episode empowers the students. I came to know that culturally relevant pedagogy builds thinking, experiences, and traditions of our students (Tate, 1995).

The purpose of the activity in the classroom is to empower students to learn mathematics. Students will feel that the discussion of tour can be taken in the context of set which is a kind of local knowledge. Secondly, I have presented about the tour of 10+2 students in the above episode which explores also the important of mathematics in a shop while buying tea and biscuits. The number of tea, biscuits as well as amount can also be calculated, using the set concept. The students were able to learn the calculation and gave more interest on mathematics learning. The primary purpose of culturally relevant pedagogy is to empower students critique society and seek changes based on their reflective analysis (Ladson-billings, as cited in Tate, 1995). I knew about the cultural practice theory or local knowledge arises from communities' activities, which are situated in contexts. I concluded that the school mathematics is only based on theories, acquired by memorizing rules, formulas and solving the problem but in contrast, out of school knowledge is acquired by working in an environment to understand the causes of problems solve ill –defined (non-standard, non-routine, natural) problems and construct personal meaning (Lave, smith, Butler, &Achoenfeld, Tate, as cited Poudel 2010, p.95).

Episode-4

Calculation of Area, volume of land

It can be any day of 1995; I was studying in grade 10. The brick factory nearby had announced to the farmers that interested farmers should sell their soil from their field to make bricks. All the neighbors started to give soil from their land. So, my father also sold some soil because they would give money. The assistant engineer called my father to his office for payment. My father asked me to go instead because he was uneducated. He said, "It's better if you go there as I don't know much about calculations." So I went to the factory to collect the money for the soil we sold.

When I reached there, the officer was drawing different triangles, rectangles on the map of my land. I was very curious to know about this. So, I asked him, "May I know about theses drawings?" He replied, "of course! Why not? I am drawing these figures on map for calculating the area of your land. The sum of all area of triangles, rectangles is the total area of your land.'' I was very impressed with this activity because I had already learnt how to calculate an area of triangles, rectangle in my class. It was related to my study. In my experience, I thought that we could only find an area of triangles and rectangles which are in the text book only by using formula. But I found that the officer was using all formulas which were taught by teacher in the classroom. I became very impressed with him and gave more attention on his calculation because it was related to my mathematics which I liked most. I was observing his calculation and he found the total area of my land was 9326.31 sq. ft. I also checked it and got the correct answer. The officer had calculated the area of our land in sq ft. but I knew that my land was 1 ropanee, 11 Anna and 1 paisa (relation between ropanee, Anna and paisa is given below). Again I was curious to know about the relation between ropanee, Anna, paisa and dam (units of area calculation in Nepal). He said to me, "Ok. Listen, Carefully! Everyone should know this." and taught me. That's how I learnt about the units of area calculation in Nepal as given below which were new for me:

508.74 sq m=1 ropanee= 16 Anna=5476 sq. ft.

31.79 sq m=1 Anna=4 paisa=342.25sq.ft.

7.94 sq m=1 paisa=4 dam=85.56 sq. ft.

And then I took a piece of paper and tried to calculate the area of my land and got the same area which the officer had already calculated. I was very happy to learn this kind of knowledge. I thanked him a lot. Although it was starting to get late for me

to go to school, I carried on talking to him. At last, he calculated the total money of soil. I was looking carefully about his calculation. He did it as the product of area of land (9326.31) in sq ft., height of soil (3ft.) they took and price (25 paisa) per cubic ft. as following way:

Volume of soil = 9326.31 $\times 3 cu.ft.$

Rate of soil per cubic ft. = 25 paisa

So, total money =699473.25 paisa=Rs.6994.73= Rs.6994 (approximate)

I compared it with volume of solid figures and cost estimation which was done by me in the classroom. I got Rs.6994 from the officer and giving thanks to him, I came back to my house.

The above episode is related to my lived experience. As a brilliant student of mathematics in my class, I was always proud of me for being good in mathematics. I thought I would be perfect in mathematics. When I got the chance to meet the assistant engineer, it was very valuable for my life. I got such kind of local knowledge which is very important for us. My teacher's approach was different. He always did the calculation of an area of triangles, rectangles which were only in text book by using formula. He never taught or linked with lands. So, before visiting sub engineer, I didn't know the use of area of any figures. I knew only that we could find the area of triangular shaped, rectangle shaped and so on. The sub engineer had drawn different types of triangles, rectangle on map and easily calculated the area of irregular type of polygon (land). By this I knew the application of mathematics in our life. This inspired me to learn mathematics more and more. According to Valero (2007), "since mathematics is a powerful knowledge in our society, then it is important to improve the access of as many students as possible to a quality mathematics education so that they get empowered." Mathematics really plays a great role in our society. Because it

is used in every step of life and it has power. If there was no mathematics knowledge while calculating the area of land, surely that would be difficult. The mathematics of sub engineer encouraged me to learn that mathematics is very important for our daily life. I have the knowledge of mathematics which has power. The power of my mathematics pushed me to learn more about the calculation of area of land, volume of land and money of soil which the factory had bought for making bricks. If I had no knowledge of mathematics at that time, I would not be serious on calculating. So as Valero (2007) said mathematics has power and that therefore, mathematics can empower those who acquire it.

Similarly, Skovsmouse's concept of 'socio-political roles of mathematics' tells us that the main role of mathematics education is to develop mathematically literate people who can be active , reflective and critical participators in activities that extend beyond the classroom and have a communal perspective. The learners are thus encouraged to make their own judgment of the classroom activity, which may not be always, be in accordance with what counts a school curriculum. The students will not just understand the content and gain competency but they also develop an inquiring mind about the nature and the ethics of mathematical applications in real and authentic problems. Moreover, the students become more responsible in decision making processes demanded in our personal and social lives. The students will know to use mathematical tools effectively in varied applications and take mathematics as technology for the modern world.

Episode-5

Teaching mathematics contextually

In November 2013, I was in Shree Harisiddhi Higher Secondary School, Harisiddhi, Lalitpur, Nepal, teaching grade 10 students. I had to teach the students

about "sphere". As a student of K.U, I had to use or connect it with local materials or culturally contextual materials so that they would learn the content more meaningfully. I had planned to perform a demonstration in the class and make it an interactive class which would be more suitable to for students to learn.

Usually, every teacher only follows the text book problem which is not enough for learners. The students were excited by some materials I had in my plastic bag. Slowly, I opened the bag and showed the contents of the bag to the class. I asked the students, "Do you know what it is?" Students (altogether) replied, "Orange, sir". Again, I demonstrated all the other materials I had brought and asked the students to name them. They replied football, volleyball, shot-put, etc. Suddenly, I came to the point and support them to relate the content sphere.

"Have you heard the word ***sphere*** *in your home?" I asked them pointing to the board. Many of them seemed to be confused and buzz sound noisy. I controlled the side talk and said, "These all items are spheres. There are lots of solids which are used in our daily life." One of the students, named Nikita said, "If so, my dad always eat lemon. Lemon is a sphere. Is it?" I was very happy with her argument. Again I added, "thank you Nikita! Ok my guys, all of you have name the material (sphere) one by one which are used in your home or culture. Do you agree?" they started answering one by one.*

Figure 25: Laddoo

One student: My elder brother got a job in bank yesterday. So, He brought a "Laddoo". It is a kind of a sphere. Isn't it?

Me: of course. You are right.

Another student: I like table tennis. So I always play it. Here, the table tennis ball is sphere.

Next student: my mother uses spherical soap for washing clothes.

Next student: our social teacher uses globe. It is also sphere.

Similarly, all the students gave an example of spherical items used in their life one by one and I listed all materials on white board as given below:

Laddoo[20]*, Table Tennis ball, Globe, lemon, orange, spherical soap, eyes, lal Mon, basket ball, hockey ball, grapes, tomato,watermelon,guava and so on.*

The peon of the school rang the bell which indicated me to stop the class. So, I came to conclusion and asked to the students, "Do you understand the concept of sphere? Tomorrow, we will discuss about the surface area, volume of sphere." Students replied (one voice), "yes". One student (Bipan) said, "We understand it well and it's very interesting. Mathematics is everywhere." Another student said, "It is easy to understand the concept of sphere by comparison of solids or materials from our day to day life or culture." I was very happy with those students who were still discussing the use of spherical solids in our life but the time was over. So I said to the students, "this much today, we will discuss again tomorrow." I left the class.

Before joining in the Master's degree in Kathmandu University, I did not know that mathematics is not only in the text book, but also in our day to day life. I came to know that it is not a culture free subject. Poudel (2010) argues that cultural contextualization is a process of adapting the concepts of mathematics in relation to the social and cultural values of the places where the learners live. So, while teaching "sphere" to the students, I tried to create the environment for sharing their own

[20]Laddoo is a ball –shaped, a kind of sweet which is made of flour and sugar with other ingredients that vary by recipe. It is often served at festival or religious occasions.

cultural materials. Students found this very interesting and wanted to discuss again and again. This kind of class helps the learners to understand the value of learning mathematics and find appropriate uses of mathematical ideas in their current lives. I must follow a way of teaching mathematics so that the students may realize some general human value before they grow gray (Archibald, 1932, as cited Poudel, 2010, p.95). The topics, which we are going to teach response or relate the students' life, culture, and then students, will realize the value of mathematics. Lerman (2000) have argued that the growing attention during the last 20 years to the social aspects of mathematics education could be rooted in the political concerns of some researchers who saw that "inequalities in society were reinforced and reproduced by differential success in school mathematics (p.24). According to Valero (2004b), this initial political awareness has not necessarily led to the constitution of a socio-political approach in research. Furthermore, he discussed about the power of mathematics and mathematical learning in following way:

When one says that teachers can empower students, it is further assumed that the capacity that makes teachers powerful (in this case knowledge) can be transferred. Teachers transfer knowledge to students and as a result students acquire power. It is in this way that education is an empowering process. Knowledge allows students to think and therefore act in appropriate and desirable ways in the society in which they live. Students have gained power, which they can later exercise in relation to other people and other situations inside and outside the school.

I support his argument. We, the mathematics teachers can transfer a very special knowledge to the students and in itself powerful knowledge. Students are from different cultures. If they are guided by incorporating the local context, they will be empowered and want to learn more. I mean that Teachers, the possessors of

knowledge, transfer mathematics to students who then become empowered by the acquisition of a knowledge that allows students to exercise powerful actions (Valero, 2004). Moreover, culturally relevant teaching empowers students, giving them opportunities to excel in the classroom and beyond. Empowering translates into academic competence, personal confidence, and courage.

Episode -6

Using mathematics in daily life

It could be any day in 2013; I had visited my supervisor with a hard copy of my thesis up to seven chapters. After sharing my concept of thesis, my supervisor advised me to add one more chapter about "local knowledge empowers the learners." According to my supervisor, I had completed it and again submitted to him. It was November, 2013; I got a mail from my supervisor. One of his suggestions is:

"Dil ji, this chapter is one of the most valuable chapters. This chapter relates your research with very sensitive dimension of society the "empowerment". You have tried very well, but it needs depth and analysis by the help of literature. Please use the literature carefully, Paul Ernest, Paulo Valero, Paulo Freire, Ole Skovsmose-etc. can be useful thinkers. Please pay more attention to this chapter. You can demonstrate your argumentation power effectively in this chapter. You may discuss how local knowledge empowers local people in their daily rituals and you can take examples how incorporation of local knowledge empowered learner to help own their knowledge and feel confidence in application. Relate to daily life application inside home to family businesses etc. you may also talk about how incorporation of local knowledge to classroom empowers learners to be critical, conscious and capable to understand changing situations in the contest of globalization."

It was so difficult to prepare the events immediately relating to empowerment. I had read other writers' papers which are similar to my research. On the way of thinking my 6th chapter, I felt very tired and wanted to take rest. So I went to bed. After a while, I slept but saw a dream about my 6th chapter. In this dream, I was talking with my supervisor about the use of mathematics in our daily life which empowers the students. The dream I saw, is given below:

Good evening sir! First of all, I am very grateful to you and want to give thanks for giving valuable suggestions. My supervisor also welcomes my gratitude and asks me about my thesis. After that I am ready to talk about the use of mathematics. The mathematics which is taught in classroom is not only bounded in classroom but also used in our daily life. Knowingly or unknowingly, students as well as uneducated people are using mathematics. It is important for us. It should be taught in the classroom by giving it a conceptual meaningful. The students should be motivated to learn mathematics. Similarly, empowering students is the most important in teaching and learning. It translates into academic competence and confidence in learning. Dear Sir, I want to give some examples of local materials or local knowledge which empower the learners to learn mathematics as:

The commercial mathematics includes discount, banking, stock and share, foreign exchange, profit and loss, interest, time problems which are frequently use in our daily life. While teaching these topics in the classroom, we should connect with our daily life at first. There should be such an environment created that we could interact to each other about banking, discount, interest, profit and loss and so on in the classroom. If so, the students automatically learn mathematics and are more confident. While talking about banking, we have to discuss about it such as bank is full of transactions, in turn the transaction is nothing but mathematics. Similarly,

banks are also involved in stocks and bonds. Bond calculations are mathematical. Stock options are also very mathematical.

Daily life would be very difficult without math's knowledge at all. To begin with, we need to be able to organize and count our money, as well as subtract, divide and multiply. This is a skill everyone needs to have in order to survive. Every day we visit markets to buy some items, without math's knowledge, we would not able to know about the currency required to pay, quantities of items to buy and so on.

In the field of architecture and engineering, it is essential to have more advance mathematics knowledge. Similarly, geometry and algebra helps in reasoning skills to solve technological problems in life. Many other jobs also need workers to apply mathematics such as construction of building, plumber, electrician, and accountant of any institution, scientist, mason, and painter and even rally drivers. Without the knowledge of mathematics, they cannot complete their work.

Figure 29: construction

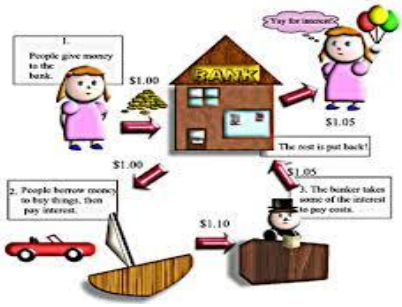


Figure 28: Banking

Dear Sir, I think, I am going to reach my destination, am I right? My supervisor replies, "Yes. You are coming closer to where I want you to be. If you enter these kinds of arguments in your thesis, your research will be better." I am very pleased and again want to talk about local mathematics which

should be taught or connected to school mathematics. I like to share which I usually create in the classroom. On the way of talking with my supervisor, I give examples of managers, players who also use mathematics in their life. The mathematics concept can apply when one wants to comment about the game, the player's analysis and much more. Similarly, coaches and referees of different games make calls which are based on time, statistics, all the past game played and players , their success failure rates can only be worked out using some aspects of mathematics. By discussing or creating these kinds of mathematics environment in the classroom, obviously, students will agree to keep the mathematics as very important and learn it curiously. Is it Sir? My supervisor, "Good Dil sir, I support your arguments. This will be better in classroom discussion."The nice language of my supervisor is supporting me to add some uses of mathematics concept which empowers learners in the classroom. So, I talk about money, calories, time, weight, height, distance which are involved in our daily life, will not exist without mathematics. Also, we can find the mathematics in nature. 0, 1, 1, 2, 3, 5, 8, 13, 21, 34… this is

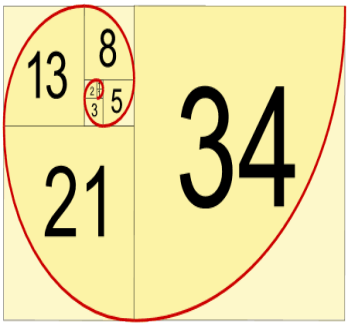


Figure 30: Fibonacci sequence

Figure 31: leaf

Figure 32: Sunflower

the Fibonacci sequence[21], where each number is derived from adding the previous two numbers. This sequence of numbers can be found in many natural patterns like in sunflowers, pineapples and so on. "What a good and beautiful example of mathematics is in nature! Really, your thinking power is great .I like it. The concept of mathematics in nature empowers the learners. There is lots of mathematics in nature." When my supervisor is saying this, the alarm goes off and it is time for me to get up. I wake up and realize my supervisor is not with me and I realized it was my dream.

On the basis of my dream, I have generated the above episode because it is useful to think about the uses of mathematics in our daily life. According to the episode, everything referring to our daily life such as building construction, cooking, games, baking, discount, computers, electronics, credit card, medicine, newspaper, streets, brides, driving, etc. are based on mathematics. Materials which we use in our daily life are produced by way of processes packed with mathematics. So, I can say that mathematics is an integral part of both techno- nature and life –world (Skovsmose, 2010, p.16). Similarly, Restivo& Collins (1982) mathematics thus embodies its own social history, and uses it as the base upon which its current community activities are constructed. The mathematical knowledge in home and community are practical and practice based. My concern is to incorporate local knowledge which is arising from home and community- based practices in school mathematics. In my opinion, it is necessary to investigate first the 'indigenous knowledge', in order to be able to build

[21] The Fibonacci sequence is named for Leonardo Pisano (also known as Leonardo Pisano or Fibonacci), an Italian mathematician who lived from 1170-1250. Fibonacci used the arithmetic series to illustrate a problem based on pair of breeding rabbits." How many pairs of rabbits will be produced in a year, beginning with a single pair, if in every month each pair bears a new pair which becomes productive from the second month on?" the result can be expressed numerically as :
1,1,2,3,5,8,13,21,34,..(Rouse,2007)

effective bridges from this “indigenous knowledge “to the new mathematics to be introduced in the school (Gerdes, 1988). Here, indigenous knowledge is originating and living or occurring naturally in an environment which should be given to the students before starting school mathematic

Chapter summary

In this chapter, I have discussed about the empowerment. I have presented six episodes which are based on my lived experience. In the first episode, I have tried to give the importance of local materials in the classroom. Without any local concept, I was unable to explain clearly when my friends asked me about the theorem. When I had opportunity to learn same theorem by another teacher with local knowledge, I was able to understand the concept of the theorem better. Similarly, in the second episode, I have presented a movement of my life. In this episode, my son plays a vital role to consider local knowledge. Egg and potato can be taken as an oval which was taught in the classroom. In the third episode, I have tried to show my teaching style after being the student of K.U. which also empowers the students. Likewise, I have presented in fourth episode about my lived experience of calculation of an area of a field, volume of soil which motivated me to learn mathematics more and more. By fifth episode, I have tried to present about contextual mathematics and my dream of teaching mathematics where learners empowering in mathematics is in the 6^{th} episode.

The empowerment plays a vital role in learning process. So it is very important in teaching and learning process. We know that without the audience, there is no value of stage. Without active students, there is nothing to teach. For active participation of students, local knowledge plays an important role. There are different students having from different cultural background. They are active in the classroom

when their values and practices are discussed and are able to share their knowledge amongst each other. Paudel (2010) says that real life problems may help students construct meaningful understanding of mathematics. I agree with Sharma (Boate, as cited in Poudel, 2010) that when the context is recognized as a power determinant, then an educator feels that everyday life context is easier than the abstract context.

I agree with Luitel (2003), contextualization in pedagogy demands teacher to understand mathematics as a subculture that comes from discourse community and contemporary society. Most learner in our context feel that our schooling and academic system is as one way border crossing (Giroux, 1992). It is a real matter that the teachers and the students leave their home culture while studding mathematics in the classroom. They read and write about the alien culture of the school. There are gaps between school mathematics and home mathematics. We should try to relate this with each other so that they will be close and all are benefit. For example, while teaching profit and loss, we have to give the example of a shopkeeper selling 1 kg of potato, selling a ropanee of land, selling grains etc. which are related to our day to day life. So, that mathematics is a vast subject and many things to be learned under it and it is a day to day mathematics. Luitel (2009) mentions that mathematics lives in various day to day works, embedded and embodied in the society as cultural practices.

CHAPTER VII

THE CHALLENGES OF INCORPORATION OF GLOCAL KNOWLEDGE WITH SCHOOL MATHEMATICS

Overview of chapter

We, the teachers always think about the best way to convey all the concepts that are taught in class so that all students can use and retain that information. For the clear understanding of the individual lessons, we have to know the interconnected pieces that are built upon each other. How can a teacher communicate effectively and meaningfully with students who wonder about the reason for, the meaning and relevance of what they study in the class room? Also how can we open the diverse minds of students so that they can learn concepts that will open doors of opportunities for them throughout their lives? These are the challenges that all teachers face every day. The challenges that a curriculum and an instructional approach are based on contextual learning which can help them face successfully. The main problem is that students are unable to make connections between what they are learning in the classroom and what the teachers are teaching them. They think the study is only for upgrading and essential for life, but not think about the use of learning. They don't know the use of learning. This is because the way they process information and their motivation for learning are not touched by the process we teachers are currently using. We follow the traditional approach and we also use the traditional approach so that the students have to face difficult on understand the mathematics concept. The students desperately need to understand the concept when they relate or connect to their daily life and the larger society where they will work and live. As the increment

of higher academic and works skills, the challenge, there are many challenges to help all the students that grow stronger. So the betterment of effective and meaningful learning, the curriculum require not only a stronger academic and higher caliber of work skills, but also a better understanding of concept in our daily life and the glocal knowledge , skills connect with academic concepts. So in this chapter, I am going to elaborate the challenges when incorporating glocal knowledge with school mathematics. For clear understanding of this concept, I have generated some episodes relating to my real life or my experiences as teacher and a researcher.

Episode-1

Mason and his mathematics

It can be any day in 2011, there is a preparation of a new building in the school where I work. A skilled worker, mason (contractor), named Chandra Bahadur, and had already finished the plaster of all floor rooms. According to the agreement, the school was going to pay him for the completion of the plaster. The cost for plaster per square meter is Rs.8.For the calculation of total cost for plaster, there was a need to find the total area of rooms where he has plastered. The chairman of school building construction committee and my head teacher said to me," you are a mathematics teacher. So you have to calculate the total cost for plaster. "I replied to my head teacher, "I will do it very easily by using my students of grade 9. They can calculate the total area of walls which is plastered by the contractor." *But my head teacher was hesitating of my proposal and said to me," you are very lazy. Why do you want to use students?" I replied to him," I am teaching the students about the mensuration. I want the students to apply the in practical situation." The head teacher said to me," you are over speaking. It is your work not the students'. So do it yourself."*

By this, I was very sad about my subject. Being a mathematics teacher, I have participated in many seminars and training. I know that the practical method is better than any other methods. I want to change my teaching style other than what I learned. Before going to the classroom, I always remember the John Dewey's words that if we teach today as we taught yesterday, we rob our children of tomorrow (Dewey, 1916). My head teacher rejects my proposal. There may be reason. May be the work needed to be done immediately. If so, it is better way to use of the students for that work. There is proverb in Nepal; "*Pashupati ko Yatra Sighra ko byapar*" this is similar to "*one stone kills two birds*". My plan is was that the students could learn about finding the total area of walls, ceiling, floor and total cost for plastering in practical way and this was also necessary for Calculation of total cost required to give mason Chandra Bahadur. I realized my head teacher is guided from more traditional approach.

Although I wanted my students to apply the field work, I have to calculate the total cost for plaster by myself. For this, first of all, I say to the contractor," please give me your sum of plaster." He does what I want. When I see it and I am very confused. He has measured the area of wall by using running feet (language of contractor). I ask to him again, "What do you mean by running feet? How is it measured? Can you tell me?" he replies me, "yes. For this, we have to measure the total length of surrounding the wall and then measure the height of the wall. Then multiply length and breadth and get the area." It is very easy to calculate. But I am very confused about the calculation. Is it correct or not? While in school mathematics, we used to find the area of

Figure 33: Plastering on four walls

the wall by using formula "A= 2×height (length +breath) ". For this we have to measure the length, breath and height of all the parts of wall and using the above formula, we can find the area. So I want to measure the area of the walls by myself calculation what I have learned and I have taught. Using the formula, I calculated the area of the walls and compared with the earlier. I got the same measurement as the contractor.

On this condition, I remember Luitel (a researcher) who argues that "Mathematics as an 'im /pure knowledge system. I also agree with Luitel. In this paper, he mentions about the synergy of the pure and impure knowledge and creation of other forms of mathematics by its synergy, thereby giving equal importance on both aspects of mathematics. Here, the calculation of contractor is a kind of impure mathematics and used in everyday life. It should be included in the mathematics curriculum. The calculation of the area of the walls by me is a more of a pure mathematics. Moreover, while talking with Chandra Bahadur, about the calculation of the area of the pillars, I am very satisfied with him. Although I am a secondary level mathematics teacher, I don't know the mathematics of contractor. He has measured the area of the pillar by using the formula length × height where length is calculated the perimeter of the pillar. I noticed at that time, he followed to calculation of the area of the pillar, the formula," 2bh+2lh= 2h (b+l)" where l= length, b=breath and h= height. This is taught in the school but he, the contractor, is not educated. He learnt it by doing.

The mason does not know the mathematics that is taught in school but he is doing the mathematics of school that he uses the ghanti to see whether the wall where he plastered is plain or

Episode -2

The carpenter and his mathematics

It towards 2012 at 4.30, I am feeling very tired. I am taking some rest in the computer room. At that time, my mobile phone starts ringing. I immediately check my mobile. It is Lale Dai calling me. I receive his call and ask him, "Why are you calling me?"He wants to meet me because the day before I have gone to his home but I did not get to meet him. So after locking my bags and other belongings in my room, I go to meet him in his house. As a researcher, I want to know about the mathematics where it is used. My mind is always gone to remember about the mathematics. So, I want to visit Lale Dai (name changed).

I reach his home. He is not there in his factory. The workers are doing their work. On the east side, I see his wife doing work. I ask to her," how are you, sister? Have you had your snack?" She replies," I am fine? "Are you coming to meet Lale Dai? " I say," yes. But where is he? I come to visit Dai." She says," he is having his snacks upstairs. You can go visit him there." So, I walk upstairs, and Call," Lale Dai, Lale Dai." He, Lale dai," Dil sir, come to up. I am here." In the mean time, I reach

there and say to him," Lale Dai, are you fine? What are you doing?" " I am just taking rest. Please sit here. (Showing chakati[22] for me)" He replies.

Actually, I want to meet him for knowing about his mathematics as a carpenter. So, I (curiously) ask to him different questions which are given below:

Me: Lale Dai! You are a carpenter. You prepare many benches, tables, windows, doors etc. how can you make?

Lale Dai! : I prepare them by my experience.

Me: how many years have you experienced as a carpenter?

Lale Dai: about 27 years.

Me: Did you attend school as a child?

Lale Dai: yes. I have passed S.L.C. in 2041 B.S.

Me: how did the teachers teach at that time?

Lale Dai: they taught using the contents in the book

Me: actually, I am also the victim of that kind of teaching. Anyway, we studied. Now, please tell me about the experience of being a carpenter.

Lale Dai: in 2042 B.S. I worked as a helper after some months, I became a carpenter. Actually I was a helper for making sofa set. After 3 months, I became mistri[23]of sofa set making.

Me: after being a carpenter, how did you feel about the mathematics learning in the school and the mathematics in carpenter?

Lale Dai: I find that there are little bit different. I learn centimeter and meter in school mathematics but there are maximum use of feet, inch in carpeting. (Feeling opposite)

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[22] A type of mat
[23] Wood worker

Me (listening, his interesting matter, I am eager to know about his beginning): Dai, as you have said," You are a mistri of sofa set." What kind of mathematics is used in making a general sofa set?

Lale Dai: there is maximum use of mathematics in sofa set. While making a general sofa set, 2 cubic feet wood is necessary. The wood 2"×6"×8ft can be calculated as 96/144=0.666 cu.ft.

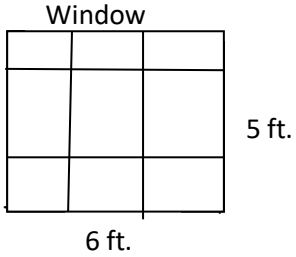
While talking about this, he said "I didn't learn such kind of mathematics in school. I learnt it while working as carpenter. This kind of mathematics is very important. But, it is not well addressed in our mathematics book, but why? His question touched my heart. I was also thinking about this question. I wanted to connect the content with school mathematics. At that time I remembered that he was talking about the volume of cuboids. The wood used in sofa set is the shape of cuboids. The volume of cuboids is the product of length, breadth and height. To change the inch into feet we have to divide by 12. While calculating he uses it. So, I said to him, "These are all in school mathematics but not well addressed because our mathematics is guided by western countries." He, Lale Dai, supported me.

Again, he talked about the window of 6 ft. by 5 ft. I ask to him," how much wood is necessary to make a window of 6×5? For this, his calculation is given below:

5×4= 20 ft. (the wood of length 5 ft. = 4 pieces)

6×3 = 18 ft.(the wood of length 6 ft. = 3 pieces)

Total = 38 ft. but in cubic feet, the total wood= 38/12= 3.1666..



I compare it with the school mathematics as

$$4\times(5\,ft.\times 3''\times 4'') = \frac{4\times 5\times 3\times 4}{12\times 12}cu.\,ft. = 1.6666...$$

$$3\times(6\,ft.\times 3''\times 4'') = \frac{3\times 6\times 3\times 4}{12\times 12}cu.\,ft. = 1.5cu.\,ft.$$

Therefore, the total wood= 1.6666…cu.ft. +1.5cu.ft. = 3.1666…cu.ft.

Again, I ask him," how can you calculate for khapa[24]?" he tells me," well Dil sir, it is calculated in the square feet. For example: if the height and breadth of a khapa are 49.5" and 21.2" respectively, then to find the total square feet, I take 50" as height and 22" as breadth. And multiply to each other as 50"×22". Hence total area $=1100 sq.\ inch = \frac{1100}{144} sq.feet = 7.63 sq.ft.$ *"*

In this calculation, he is using the concept of the mathematics of rounding off. To calculate the total amount for making a frame of window, he uses to find the total area of the frame of window. For this he multiplies the height and breadth of frame which is also taught in the school level. In my opinion, this kind of knowledge should be taught in the school level so that the students will be familiar with the khapa and teaching will be permanent .That means the students will know the importance of mathematics and indirectly involve in learning mathematics.

As a mathematics teacher as well as a son of the carpenter, I am very eager to know the mathematics of carpenter. While talking about how to calculate the measurement of window khapa, I remembered my father who is also a carpenter. If my father is alive, it is very easy to know about the mathematics of carpenter. Anyway I get more information, what I need. He is very helpful.

Thinking as above, I go ahead to ask him, "Please tell me Lale Dai, how can you measure the window." He replies to me, "It is also measured in square feet. For example: having the dimension of 31.4"× 82" can be calculated as 32"×82" = 2624 $sq.ft = \frac{2624}{144} sq.ft = 18.22 sq.ft = 18 sq.ft(approxinately)$ *". Thinking no difference in calculation, again I ask him, "I want to know about the calculation of making a door.*

[24] Frame of window

Can you tell me about it?" He, Lale Dai reply," why not? I will tell you about the door. Please listen to me and look! (Drawing the picture of a door) this kind of door of 7ft height and 3 ft breadth needs 18 ft wood." I am confused in this calculation, so ask him, "Lale Dai, how?" then he does the calculation as below: total length of the wood to make a door is 7ft.+7 ft. +3 ft= 17 ft and 1 ft for cutting wasted. For the cost of a door, he says that it is calculated in cubic feet as volume of the wood = $\frac{18}{12} cu.ft = 1.5 cu.ft$. *The cost of per cubic feet with wage to make a door =Rs.4500. so the total cost for making a door = Rs.4500×1.5=Rs.6750. in this way, he can do all mathematics in a proper way. He says, "I can do well in mathematics because I have the knowledge of mathematics of multiply, addition, subtraction in school level."*

By listening to his opinion, I am very impressed with him that the school mathematics plays a vital role in everyday life. But in school mathematics, we use to find the volume of the three dimensions is the product of length, breadth and height where as in the above scenario the carpenter uses a short cut method to find the volume of the wood to make a door. This could make the students very confused. So there will be very many challenges to connect the day to day life mathematics with school mathematics.

There are different students in the classroom. The variety of student educational / career goals in one classroom, instructor may feel cautions about using content material because it is unfamiliar. Here, I am reflecting critically about the problem of culturally decontextualized mathematics education (Luitel& Taylor, 2008) unfolding my experience as a learner and teacher. I am focusing, how our curriculum is designed under the hegemony of western modern World View thereby dislocating our social and cultural issue in our curriculum. I agree with Luitel& Taylor (2008) that western Modern World View has been developed around the

dualistic premise and have governed Mathematics curricula in Nepal, there promoting culturally dislocated mathematics education that hinders learners from cultivating their local cultural Capital. In my opinion, less emphasizing in social issues in incorporating in the curriculum has developed. So, the curriculum of Nepal depends to others curriculum. As I have presented in the above episode, Lale Dai has encountered while using feet, measuring the length, breadth and height in furnishing. If he was guided according to his work, he would not be confused. It means that unconscious thought and practice in local issues are incorporating in the curriculum. There are some images embedded in our present and past curriculum as 'an imported document', 'culture and context free text', and 'elitist syndicate' to explain disempowering features of our curriculum to make locally attached document.

The knowledge I got by talking to Lale Dai is very powerful in mathematics learning. It empowered me to learn and teach mathematics locally. In fact, Knowledge is defined by the oxford English Dictionary (Trumble, 2007) as "information and skills acquired through education or experience "or "awareness of familiarity gained by experience of a fact or situation ". There are two types of knowledge which are scientific and indigenous knowledge. Scientific generally involves western technology and global in nature where as indigenous is referred to local knowledge and considered as local. However, scientific knowledge, indigenous knowledge is dynamic in nature, continually influenced both by internal creativity and experimentation, and by contact with external systems (Flavier et al., 1995). Although, the local knowledge or indigenous knowledge plays a vital role in teaching and learning process, there are many problems incorporating it in classroom. The challenge now is to identify how the process of implementation can occur. This challenge is a potential project in itself, moving away from the traditional oppression

of local knowledge towards a culture of acceptance. In my teaching experience, I have been able to answer my students' frequent question why they should learn geometry, algebra and trigonometry? Where and how can we use in our daily lives? In this condition, my answers always used to be that it will apply in future. But what is that future and how does it arrive? I don't know about it. Once, one of my students asked me, "Sir, how many square meters are there in a ropanee of land?" I replied, "It is not our exercise right now. Just go with standard unit kilometer, meter and centimeter." Here, I am talking about examples which are related to local mathematics. The conversation between Lale Dai and I also directly connected with local knowledge / pure knowledge. The examples that depict how our curriculum is not answered to address questions thereby dislocating curriculum form our culture aspect. This challenges us to use local context in classroom.

Episode-3

Parents' expectation

It could have been April of 2012, the parents meeting was organized by class teacher of grade 10. All the parents and teachers of grade 10 were there in the staff room on a conference table. I entered and took a seat at a corner of the room. All the seats were taken. I was a little bit late. One of the parents said loudly, "who taught mathematics to grade 9? My younger sister commented that the course was not completed in grade9.Also she told me that the class was very noisy." This question touched my heart because I was the person he questioned. I felt very sad for a while. Again, another parent raised the same question. I wanted to give answers of what they needed but the environment was not right for me to talk. The class teacher, who also teaches social studies was trying to convince them and said to all parents, "The students who attended this year were very weak. We managed to provide extra classes

to students only for one month which encouraged them effectively and there will be good result in S.L.C exam. So, dear parents, we make a plan for this year that there will be extra classes from the beginning of new session for your children. Do you agree or not?" Most of the parents said, "Its good plan. We will send our children." Still some parents were not satisfied and raised a question, "It is difficult to send students in the morning. There will be problem for lunch. So, we manage ourselves." One of the parents again raised the question, "I think, there is the problem of mathematics teaching. I hear, Math teacher focuses only out knowledge and creating the environment for thinking and writing about everyday life materials. Then how can the course be complete? If the course is not completed, then our children will fail? So, manage good mathematics teacher." The principle, class teacher and English teacher together replied positively and the meeting was finished.

Although the meeting was over, some of the parents were still there talking about their children. On the formal meeting, I stayed silent because lots of comments were of my subject and I was not yet introduced as a mathematics teacher. When they were raising many questions about my subject, I was wondering why they were they complaining. I thought that I taught my very weak students very well. I shared and linked all topics with everyday life. I focused on local knowledge. So I gave project work on teaching and learning process. I spent lots of time to make them able to understand mathematics and the students were happy with me. Similarly, the result of mathematics in S.L.C. did not speak about the weakness in mathematics. I questioned to myself, "Why were they complaining about me? I always do well and am positive to all students." So, I wanted to talk to the parents who had commented. I went near them where they were still talking about mathematics. I politely gave them my introduction as mathematics teacher and asked about them. Both parents were also

tuition teachers. They also taught mathematics at tuition institute. It was easy to talk and share my feelings. When I was talking to them, I said, "To complete the course is not the only duty of the teacher; to give meaningful knowledge is the duty of the teacher. Your children are very weak in mathematics and have no base. So, I focus on giving them conceptual meaning of mathematics. For this, I usually connect and share local knowledge with school mathematics." One of the guardian said, "My sister was the first girl in her previous school. How is she weak in mathematics?" I replied to him, "Yes. I have seen her mark sheet. But her performance does not show me as she has got the marks in grade 8. She is a disciplined student and tries to do well in math and completes all the exercise problems." Furthermore, I said to them, "Able to solve the problems of mathematics does not show that he/she is very talented. For meaningful learning, the students must have the ability to share and connect the mathematics which they learn in school with local math." One of the parents said to me," but the students are going to attend in S.L.C exam. If the course is not completed by then how can they pass in exam?" I replied, "Don't worry. They are able to learn mathematics now. They all have knowledge and power to learn mathematics easily. I can teach them effectively and they can understand all the content by connecting with local knowledge." Still one of the parents was not fully satisfied. So, I said to him, "If you still unsure with my view, you can ask your sister about what changes she got and you will know about my teaching approach." After a while, we stopped talking and promised to visit and talk about the issues we raised on the next month's meeting. All parents had gone outsides and the teachers also left the room.

According to this episode, the parents have commented about the way mathematics is taught. They told me to manage calm environment within the classroom effective teaching and learning activities. They also suggested completing

the course on time. I was surprised and sad but did not show any disagreed face to the parents. I told them that there were more students. So I divided into different group for activities. I added, "When the students are doing their group activities, obviously there will be noise in the class but they are learning." But they were not totally convinced. According to them, I was a failure teacher because I did not like to follow traditional method. So, I focused to teach the students modern method. The environment created me as critical because my teaching process was different than others. My approach would be new for other teachers and difficult to understand. A good teacher is someone who is able to attend to the students need and assist each person in the way that he or she learns best (Brands &Ginnis, 1986, p.53). I wanted to incorporate local knowledge with pure mathematics by encouraging the students to think and write their own mathematics and mathematical experiences how the mathematical experiences have shaped and related in learning mathematics. I would be wonderful and get satisfied with using local materials in mathematics. I would be unable to run when I use traditional approach to teach. My mind and all the parts of the body do not support me to follow the traditional approach. It is because I am confident my concept is right. Moreover, I want to teach the students what they need to know, using textbooks only as a reference not a world. But it is difficult to follow .There are many factors such as the large number of students; parents' expectation which effect on incorporation local math with pure math in the classroom.

Episode -4

How wonderful mathematics is!

It could be September of 2012, there was a big program organized by grade 9 on the occasion of great festival Dashian.[25]*They had organized a raffle tickets for students and teachers. The program was organized not only for giving and taking, "Happy Dashian" but also to collect money for long educational tour. It had been announced that they would be taken on long tour to Pokhara. So, all students were busy on the program. Parents and students' ear were very sharp to hear the winner amongst them. Also, there were many songs and dances performed by the students. For the event, a reporter of a popular studio was announced to speak. He was a student of my school who had already passed in S.L.C and always won and got prize in speech competitions. He spoke about the program as well as about the learning process of mathematics in poetic form (which I had translated in English given above).According to him, he did not understand about learning of mathematics in the beginning. He wanted to pass in his exams but always failed. He used to believe that he would not be able to pass his S.L.C exam. He said, "The mathematics is easy for talented students but difficult to poor and weak students. Similarly, he argued that there are many formulas and symbols in mathematics which are meaningless, felt him, it is very difficult. In his opinion, Teachers come and teach what the content is there in text book.*

[25]Dashian is the 15 day long national (religious) festival of Nepal. It is the longest and most auspicious festival of the country, celebrated by Nepalese people. Usually, it falls around October –November, starting from the bright lunar fortnight and ending on the day of full moon.

On the way of giving speech, he requested to talk with me personally about teaching. So, after a speech he came near me. First of all, I thanked him because he had spoken about mathematics in poetic way and then we came to point. He asked me, "All students including me find it very difficult to do mathematics. What is the problem, sir?" I replied, 'There are many problems. Amongst them, I want to talk about the gap between glocal knowledge and text book knowledge. The students as you are from different

<u>How wonderful the Mathematics is?</u>
For talented student,
It is easy to understand,
But difficult to poor students
How wonderful it is
There are the symbols '+','-', ×' as mathematics

There are formulae in mathematics
For talented student,
It is easy to understand,
But difficult to poor students
How wonderful the mathematics is

The teacher comes, teaches and asks,"

Do you understand mathematics?"

Reply the students, "yes"

Although not understand the mathematics

Understand the mathematics while teaching,

But where goes math after teaching?

For talented student,
It is easy to understand,
But difficult to poor students
How wonderful the mathematics
Coming the exam, not to take cheat in mathematics
How the mathematics subject is
It is sad for learners
But not for teachers
But, By Hard working and
Blessing, helping and empowering by teachers

The students will pass in mathematics

culture and society, but the content of text book are out of those culture and society which make difficulties in teaching methods, using materials, evaluation and so on."

"Of course, it is correct. Is there solution, sir?" he said.

"There is a solution. But the educationist /curriculum maker/leader who prepare the curriculum don't reach on a grassroots level when making curriculums. The curriculum should be prepared on the presence of teachers, students, parents so that the content is suitable for students where they are. But in our context, the curriculum is prepared who has power and money."

The reporter agreed with my view and wanted to know more. So, I shared one story with him as given below:

Last year, I only focused on using local materials or local knowledge. Lots of time, students as well as I were busy on connecting local knowledge with school mathematics. As a result, it was difficult to finish the course and there was not enough time for doing exercises. Students, who were going to attend S.L.C examination, were afraid to take the exam. They participated in the exam and got the result, but some of students failed in mathematics. Even the talented students' score was lower than their capabilities. Parents, students and teachers felt the reason was the mathematics teacher.

Again, I agreed, "although, the teaching and learning process is very meaningful by incorporating local knowledge, I have to follow the need of the students, teachers, parents, is successful in exam." The reporter said, "Dil Sir, you are right. Anyway, teaching profession is very challenging. It is not easy what the students' thinking. I am very happy to get a chance talk to you. I have to go another program." I replied, "Ok. See you again." then he went from there and I came out from my office and was busy on watching the program.

The above episode indicates about the learning of mathematics. One of the student's feelings of learning is shared in this episode. It describes about different level of students deal with mathematics differently. According to him (student), all the students are in not same level when getting knowledge. Some are talented and some are not. The talented students can learn mathematics and weak students cannot learn mathematics. Similarly, he argued that mathematics learning is only to pass in the exam. But in my view, the teachers have to face different students with different abilities. Also, there are two duties of teacher. One is to complete the course in time and other is to teach the contents in meaningful and effective way. Incorporating local knowledge takes more time as well as not well introduced in curriculum and textbook. So, it is challenging to incorporate the local knowledge because the weak students feel that mathematics is very hard. They may feel that local knowledge is not related to school mathematics and don't participate in classroom activity.

Episode-5

Glocal curriculum

It could be any day of November, 2013. While I was revising my thesis, I reached at chapter seven. I deleted some episodes which were not suitable, and added some more episodes. On the way of adding episodes, I started day dream about curriculum. In my dream, I was in a training seminar. The topic was introducing "glocal curriculum". There were different teachers from different government school of Lalitpur district. First of the trainee introduced about the training .Each group had to prepare contents of glocal knowledge which should be put in glocal curriculum of mathematics for secondary level. I was also in a group. We were all busy doing our work. What kind of content should be kept? After a while each group presented what

kind of content should be kept in local curriculum. Sharing was very effective to use local curriculum.

In the mean time, the facilitator wrote a question on the white board. The question was, "perhaps, this is new for all teachers. There will be some difficulties. Can you find any difficulty while teaching in the classroom using the way mentioned in today's' discussion (Contextualizing with local practices.)? All participants thought for a while and then some participants shared as following way:

Participant1: The glocal curriculum is important. The thing that has no connection in our daily life is very difficult to learn. The new method needs lesson plans and without it is difficult to follow .so, we have to give more time make the lesson plans which are long. Only text book is not sufficient.

Participant2: The incorporation of glocal knowledge does not seem to empower students rather weaken them as they do not focus on hard learning.

Participant3: in my opinion, glocalization of mathematics is not helpful in academic learning mathematics in the classroom. There are many examples, can be given in the classroom but there is no single example which helps to learn mathematics problem.

Participant4: there is no specific glocal curriculum of mathematics learning. Government policy will focus and run it; there will be very difficult to teach because it is new experience for the teacher.

Participant5: in my experience, the use of day to day life in our classroom is in one side very interesting but other side, it is very challenging to use. Sometimes there may not be wider participation of all students. Active students are more benefited than those who are relatively passive.

Participant6: there should be kept glocal knowledge from beginning of learning and all teachers also should be coach and introduce about this knowledge. Otherwise Students will get confused due to reason that they have not faced such learning before.

Participant7: most of the content is not related to our context i.e. day to day life mathematics .Sometimes it is difficult to link local examples with text book exercise. As a participant, I had to also keep sound about using glocal curriculum. I supported all difficulties that earlier participants had mentioned. I also added, "It is very difficult to prepare glocal curriculum because there are lots of students from different places, from different cast and from different society. The glocal curriculum will not include all content according to their interest and need."

All participants gave hands to clap and then the facilitator took good response saying interesting program. The facilitator announced that the training was finished at and going to closing program. At the mean time, the district education officer of Lalitpur came as chief guest. On the way of giving speech, DEO argued, "local curriculum plays a vital role in context of Nepal. There are many cultures and society. There is the lack of introducing our day to day life. Learning is possible by hearing, watching, sharing to each other." All participants were intently listening when the DEO was giving his speech. At last, DEO said a poem related to local curriculum which was given along side. After the speech of DEO, the training was over and all the participnats went back to their destination but I was on my bed when I woke up.

Here in the above episode, I have presented my dream about local curriculum. The discussion is very impressive and important. For using local knowledge in the classroom,

Let's construct local curriculum
By joining our hands
Considering the needs
Of the societies
Let's consider the needs
In multicultural societies
Construct it in processes
Touching the hearts of various ethnics
Scope and order of energy class
Methods and materials
Of different classes
Are to be considered
Focus on measuring rods
And time on the top
Keeping each and every thing
Let's construct local curriculum

Instructors may not feel they have competence to teach basic skills, may not see basic skills instruction as their responsibility. Although Contextualization places students' interests and needs at the center of education, consistent with constructivism (Deway, 1966, Dowden, 2007). It is difficult in using. Maasz, J &Schloeglmann, W. (2006, p.43) Like, mathematics, so also can mathematics education have very many functions depending on the context. Alan Bishop (1990) asks if "western mathematics" could be "the secret weapon of cultural imperialism", Wenda Bauchspies (2005) suggests that, in some situations, learning could be interpreted as colonization; while Arthur Powell and Marilyn Frankenstein (1997) present ethno mathematics as a "challenge to Euro –centrism in mathematics education." Raising

such issues challenges the conception of mathematics education as being an intrinsically good activity.

Due to the lack of skilled and competent persons, curriculum for local level has not been much efficient and effective, and the inability to make the concerned authorities understand the troubles in the local curriculum has been the major problem in fact. Based on the condition from discussion, there should be a better understanding and awareness about the importance and the need of local level curriculum. Also, training and workshops to develop skills and competencies for the preparation of local curriculum are necessary.

Episode-6

No Classroom control and not enough time for teaching

Day-1

It was any day of 2013. I had to teach the fourth period in grade 9.Carrying a duster and a marker I entered into the class. It was the chapter of commission, tax and bonus from arithmetic. As usual, I created an environment where the students were sharing their knowledge to each other. I assigned them to think about commission, tax and bonus. Before entering the text book, Usually, I did this kind of activities. They had to present one by one, including glocal knowledge of tax, commission and bonus. Some students were thinking seriously about this but some were talking each other which disturbed other students. I said to them, "Don't side talk. Think about what I had assigned you." Then, they stopped and were working. After a while, again, some sounds, stood up. I saw the students and found that they were same students who were making noise earlier. I thought that they were not interested in the activity. I asked to them, "Why are you making noise gain. Have you finished your work?"

They replied and questioned me,

Student 1:"Is it necessary to think about commission, tax and bonus in day to day life?"

Student 2: sir, mathematics is only calculation. Why did you give us this kind of activity?

Student3: our previous mathematics teacher never gave us this kind of activity. This is first time for us. So, we are confused.

Student4: I think this is related to account, sir.

Student5: our course is going slowly. In first terminal examination, many questions were from chapters which haven't been taught yet, sir?

These answers raised some questions for me, "Am I going the wrong way? Why are they not responding?" Anyways, I had to convince them. When I was going to talk about the use /connect of local knowledge in teaching and learning process, science teacher knocked the door and gestured me that my period was over. So, I concluded the class saying, "Tomorrow, you will have to share one by one. Thank you for class!"

Day-2

The second day of teaching about commission, tax, and bonus was little more interesting. According to my request, everyone had prepared. They were ready to present. Some of the stories or events related to the topic are given below:

Student1: My dad works in brick factory. Three years ago, he got bonus from factory. Is it a bonus which we are going to study, sir?

Me (excited): yes. You are right. It is a bonus. Do you know how it is calculated? If no, listen. A bonus is a gift to reward performance, paid either by a private employer or by a government.

Student 2: I am a shareholder of finance. I keep Rs. 200 per month. Some months ago, there was annual program of that finance and I got Rs.114 as bonus. Sir, am I talking right?

I: yes. Good. Thank you very much. Do you have similar example like earlier student? (Asking other students)

Student 3: yes sir. My brother works in a company. Last year, I heard about bonus when my brother got it and shared with family.

I: ok. You are also saying well. Alisha (next student) Do you have heard about commission in any time at your home or …?

Alisha: yes sir .My Daddy gave some money to dalal[26] *when we had bought five ropanee lands.*

Is it commission?

Me: Yes. The money which your Daddy gave to dalal is a commission. It is a fee for services rendered based on a percentage of an amount received or collected or agreed to be paid. Last year, I attained mathematics practice books for grade 9 students. I got 5 % commission form book publication.

Mandira (next student): excuse me sir! Can we calculate the commission on the basis of percentage?

Me: yes, Mandira.

Pramila (next student): sir, I want to share about commission. Can I share with you sir?

I (immediately): why not? You can.

Pramila(surprisingly): the construction workers of my home got Rs. 5o from skilled labor and Rs. 20 from unskilled labor while Rs.1000 was wage of skilled per day and

[26] Agent or A person who acts a mediator between buyer and seller

Rs. 450 , that of unskilled labor. Here, the commission is not calculated as you discussed in the class.

Me: thank you for this example. There might be agreement between workers (skilled and unskilled) and agent (mystery) not following on base of percentage. The school mathematics is not totally followed by pure mathematics. So, the event you have shared here are not included in our text book and …

There was knocking the door from outside, indicating the finishing time. So, I left the class. Before I got outside the classroom, I gave information about the next day's activities. At that time some students were whispering. Again, I asked, "Are you thinking boring? Some students were saying "no sir. Today, we felt very interested." But some were saying, "Yes." I said to all, "it's ok." Tomorrow we will do an exercise related to bonus." The students (one voice) said, "Ok, sir."

We believe teachers must be knowledgeable and sensible to different cultural and social issues. The teacher must have understanding of today's activities (cultural, social and so on). Opportunities should be given to the students to share their own cultural experiences i.e. local experiences. In the above episode, I have also tried to create such environment in the classroom so that the students feel his/ her importance and freely contribute to the classroom discussions. The key to human behavior is neither motivation nor self interest. The capacities of human beings know how to act and acquire the situation. The situation, which I had had in my - experience while glocalization of teaching mathematics is, challenges me to adapt their behaviors. Different students are there in the classroom. They are not interested in learning. Efforts are already under way to support teaching mathematics without connecting the glocal knowledge. So, when I was trying to connect glocal knowledge, some students carried on talking. Because the class where students learn by doing, they move,

discuss, and share their views, make sense of learning by discussion , cause the noise in the classroom . Can we follow thoroughly this approach of learning? Can we shift from our traditional approach to this approach? Can all teachers endure such noisy class and fulfill specific objects? Do guardians take such approach of teaching and learning effective? These are challenges of glocalization of mathematics teaching.

Similarly, our pedagogy is mainly guided by technical interest where there is some fixed rule, formula that a teacher should strictly with time constraint. The classroom where incorporating local knowledge demands more time, not only in class but for the preparation for not only teachers , all concern side parents, school administration, students, curriculum designer and supporting staff should be prepared mentally and physically for the management of time for glocalization classroom.

Therefore, I would like to quote Lindsey, Roberts and Campbell Jones (2005, p.xv) as:

"Cultural and social diversity is certainly not a new issue facing us as humans. It has always existed, and we remain challenged by it. However, the burgeoning complexity of our times calls upon us as educators to face this challenge more directly, to value diversity, honor it with integrity, and to preserve the cultural dignity of our students."

On the second day of teaching about commission, tax and bonuses, I was a little more satisfied because I had created such environment in the classroom that students could share their own knowledge amongst each other. They brought interesting matters of the topics in the classroom that I forgot my time period in that classroom. I included this episode in this chapter to portray and show that there is a challenge to incorporate local knowledge in school mathematics teaching. There are many issues related to the content which takes more time. Moreover, one student presented an issue which was

directly depended on curriculum. All knowledge is not addressed in today's mathematics curriculum which effect on localization.

Chapter summary

This chapter portrays the challenges of incorporation of glocal knowledge with pure mathematics. Although it is the best way, incorporating the glocal knowledge with school math or pure math, the environment does not support and it is very difficult as a result. In my view, the students will get the vision of mathematics if they have been taught in such way that all activities are localized. They will know the uses of mathematics in daily life. In this way, the students will be encouraged to learn mathematics, then it is very easy to teach for them and teaching learning activities are meaningful and effective.

As we know that we human beings are extraordinary and creative animal. We also know that human beings are change loving creature. So, to develop, to increase and to progress, we need to change. There are two types of changes; either positive or negative. Change is not always positive but can also be negative. Change is adapted to succeed in science, it is based on motion. If there is no motion, there is no life. We have to open our mind to change. If we close our mind, we cannot change. Effortless changes are natural changes and all natural changes cannot be human loved. Human efforts are required to achieve changes their expected way. To bring newness, we need to change. If we need change, we need to change. To bring newness, we need to change to change quality and quantity of actions/efforts .Actually, to change us need attitude ***(environment), skills/opportunities/inputs, and practice/behavior/experi*ment.** Therefore, we have to update ourselves to adapt the changing time. It is possible by creating environments that will be challenging, supportive and technologically equipped. To fulfill the requirements for the

development of human beings, there should be good curriculum because it plays a vital role in the teaching learning environment. According to Luitel (2009)," The curriculum designed should be the synergy of pure and impure forms of mathematics and contextualized which provide students and teachers with much needed access to multiple forms, views and approaches to mathematics. In fact, with the help of the curriculum, teacher can teach to students. At that time, they can use different kinds of dimensions of mathematical teaching. I mean that the teacher discusses the content as well its background if possible. Likewise, the teacher can use the pedagogical knowledge to give the main objectives of the curriculum. Furthermore, while teaching in the classroom the facilitator or teacher can relate the mathematics with the culture of each student.

CHAPTER VIII

CONCLUDING MY JOURNEY

Chapter overview

This chapter focuses on the conclusions of my study. I have already prepared the entire seven chapters but this chapter takes a longer time. I have to recapture all activities in this chapter. While I am going to start, my hands do not work. My fingers touch the key board of my laptop, but no letters/words are typed. Although it happens to me, I remember to my friends, teachers and professors who give me great inspiration to complete my thesis/project and try to write some things to conclude my study.

Knowingly or unknowingly, I come to this stage. All the time, as a student, as a teacher or a researcher, my mind is going to the incorporation of glocal knowledge with pure mathematics. So I try to my best by deeply studying about my research and try to incorporate the glocal knowledge with pure mathematics on the basis of my experiences. Actually my purpose of the study was to explore a more in depth understanding of mathematics teaching in classroom by relating our everyday life materials. In this chapter, I have recalled all the activities from the beginning to the end of this document to represent my ways of this study including my research dilemma, looking back at my research questions, implication and future directions.

My research dilemma

I have gained a lot of experiences when learning and teaching. I have done many action researches (the use of three dimensions solids in mensuration, action research on low performance in mathematics education) and case studies (A case

study of a student, named Ashmita, Sarina etc.) in my academic area. This is my first experience to write a thesis. In the beginning, I felt that thesis is not a great work to finish on time and to get good grade in the exam because I had the knowledge of doing action research and case studies which are small compared to thesis. I considered that I would do better in thesis. So, I joined K.U. for my master level in mathematics education on February, 2011. In the third semester, I got the knowledge of SPSS class which encouraged me to start thinking quantitative research paradigm. In the same semester, I got an opportunity to attend research methodology class with a renowned researcher in qualitative research paradigm with award of youth scientist. I became totally captivated with his ideology about multi-paradigm (Tailor, 2008b) research field thereby giving myself example opportunity to represent my subjective view in the field of research. His ideology inspired me to study on the field of multi-paradigm research. So, I started my journey of research under multi-paradigm to explore my lived educative experiences and practices on incorporation of glocal knowledge in pure mathematics as a learner and a teacher.

Looking back to my research questions

It was around April 14, 2012; sitting on a chair of computer lab at my college, I opened my mail and saw a message by my professor, research facilitator, "All of these research issues are researchable. I would think first two could be more appropriate for M. Ed. level study. Please start writing chapter one of your proposals". I became very happy after reading this message. Actually, he had assigned us about "*Discuss (at least) three issues or problems that you would like to address in your research. Also mention possible paradigms that you are going to use whilst addressing your research problems*." As first assignment of research methodology in 3rd semester according to the question, I had sent three issues which are given below;

- *How can we relate our daily life mathematics and school mathematics in the teaching to make the learning process for easy understanding for the students?*
- *What kinds of educational materials can be used in teaching mathematics for clear understanding of mathematics learning***?**
- *The mathematics is used in every step of our daily life. But the large number of the students is hesitate to learn this subject and failed the exam. How can we minimize the failure percentage in S.L.C. exam?*

My interest was towards the first and second. I was unsure whether to choose first or second topic. I started to recollect my past and present experiences about learning mathematics which of course would be the source of my research questions. I remembered about past life thinking as past is experiences for present and present is application. I remembered all of my happiness and sorrow, joyful and painful, sunrise and sunset from landscape of my memory of teaching and learning. Some of these were erased and some were remarked and embarked which helped me to consider my research issue. At last, I thought it would be better to choose the first one thinking the second one would be used or considered indirectly. Being a middle person and older son of family, I had to give more time to do work in home. I got the local knowledge while cooking rice at kitchen, helping my father with furniture, playing different local games. These memories pushed me to think about the first issue and came to conclusion to study on *my incorporation of glocal knowledge or artifacts with school mathematics*. To polish my issue, I have presented different genres such as episodes, poems, narratives, metaphors in different chapters as my data text of my research.

According to past memories, while learning at primary school level, I learned counting numbers 1, 2, 3 and so on and compared with my mother's counting style. Most of the time, I stayed in the kitchen and learnt about different geometrical shapes

such as plate, Nanglo, Chalani, and different pots etc. I learnt mathematics in the school without any conceptual framework of understanding. The classroom was fully rote memorization. There was punishment instead of teaching if any student was unable to read and write. Because of corporal punishment, my child psychology, I became a silent learner thereby suppressing my desire from fear and control of teachers in school. Although I was able to solve all the questions of text book, I was learning nothing at that time. There was no connection between text book and local mathematics. As a result, I found it very difficult to learn mathematics in higher level. Thinking mathematics as an important subject, I choose it as a major subject in the college level, but did not get meaningful learning. Professors came into the classroom, picked up the notes of theorems, wrote on the blackboard and said that these should be memorized. Is mathematics only a memorization subject? Is it only rote learning? What would be right way of learning mathematics? Is there any application of mathematical theorems? These questions were raised by me as a teacher, as a student and as a researcher of mathematics learning and formed my first research question which is given below:

My 1st research question:

- *How did I experience change in my perception about learning /teaching mathematics as a "pure math" to "glocalised" subject?*

  To address this research question, I have presented different narratives such as episodes, poems, pictures etc from my educative journey as mathematics learner (student, teacher and researcher). After reading this paper, learners might think that my narratives are only the collection of reflection of my past life (history) but it was not only the reflection , it was real lived experience of my life as a student at different levels and teachers in different situations. I have used narratives as *mathematics as*

food, games and farming, everyday problem solving to rote memorization, being there and here, mathematics as a hard subject. Similarly, I have presented different poetic logic to explore my first research question such as *my mathematics teacher, searching college, life is an equation.*

The episodes, poems, pictures which I have used mostly in the paper explore my learning of mathematics. All of these show my experience of perception about learning /teaching mathematics as "pure math" to "glocalized math." I have discussed my learning experiences of glocal knowledge and it's important in pure math.

My second research question:

- What changes in learning experiences do students express towards the use of glocal math "knowledge "and artifacts?

To address this research question, I have presented different teaching experiences of my own life. I have critically represented the episodes and further verification I have presented narratives in poetic way. In this research question, I wanted to explore the reflection of students towards the use of glocal knowledge and artifacts in mathematics learning. This research question is most important for me because I am going to study about this whether it is good for teaching mathematics or not. So, to explore the second research questions, I have used different narratives (episodes) of my lived experience such as *more meaningless and no punishment, mathematics is everything, VAT in mathematics, actually we learn through glocal activities, collaborative competition, pyramids as local contexts, area of four walls.* In addition, I have added some poems and pictures to clear understanding of my second research question.

My third research question:

- How does incorporation of glocal knowledge empower learners?

This research question is most important for my study. It covers the reasons to learn mathematics by incorporating the glocal knowledge with pure mathematics. It weighs the empowerment of local mathematics. Similarly, it explores the importance of using glocal knowledge and artifacts in school mathematics. Moreover, it describes that the glocal knowledge empowers the learners. To have the meaningful teaching and learning, learners should be active. The students should be empowered. Otherwise, teaching and learning are meaningless. So in my research, I have discussed about the empowerment. I have tried to establish, the incorporation of glocal knowledge and artifacts empower learners/ students. For this, I have presented different narratives as *Ptolemy's theorem as memory, egg &potato as oval*, set *in the classroom, calculation of area and volume of land, teaching mathematics contextually, and using mathematics in daily life.* So that any learners can understand about my study.

My fourth research question:

- What are the challenges I experienced in incorporating glocal knowledge with formal school mathematics?

This research question is also very important for my study. Although incorporating glocal knowledge in classroom increases likelihood of transfer of skill and motivates to learn basic skills, many difficulties and constraints occur which makes it challenging to incorporate the local knowledge. To address my fourth research questions, I used my narratives as *Mason and his mathematics, the carpenter and his mathematics, Parents' expectation, how wonderful the mathematics is, glocal curriculum and No classroom control and no enough time for teaching*. As a teacher (me) and students, I still have to face many challenges when incorporating glocal knowledge in classroom. To reduce the challenges, there should be support from

government. We have to consider different sectors as students' interest, teachers' interest towards the local knowledge. Different seminars and training should be provided by government.

Implication to others and myself

I think this study plays an important role to incorporate glocal knowledge approach in teaching mathematics but it is not highly implacable for all and forever, however it can offer some insights to the teachers, readers and novice researchers regarding our pedagogical practices. From this study, teachers, students, parents, curriculum reformer etc. who wants to envision for change regarding pedagogical practices might be of benefit. I don't have anything to claim at this stage apart from me becoming aware of my own limitations. To those who are still adopting teacher centered, text book centered classroom practices and suffering from different anxiety may get some insights from my exploration. Similarly, students may also think about reducing influential factors for conceptual meaning making process. This study also might be helpful for those parents who have different beliefs towards their children's achievement. This study also might be helpful for curriculum maker, text book writer who are writing mathematics book without local concept. Incorporating glocal knowledge is a challenge to use in Nepal and new phenomenon, so, this study helps every educational field to acquire the knowledge. If school administration, teachers, curriculum maker, educationist, and governments feel their responsibility to create such environment, it will be a new innovation in mathematics teaching.

Future Directions and possibilities

Before concluding of my journey in this study, I have come to realize that this study or research is my first foot print from initial stage of learning and teaching to endless educative journey. I have encountered many insightful ideas, vision on my educative

practices especially to local knowledge learning, citizenship mathematics education, curriculum and ethno mathematics , mathematics learning through educational materials and collaborative learning in mathematics education about which I could not incorporate in this small size study nonetheless this study is milestone in my pedagogical practices.

Local knowledge learning

Researchers, educators and teachers who take on a local knowledge perspective believe that many factors such as cultural and linguistic background, social, moral values and lifestyle come into play when mathematical ideas, procedures, and practices are developed by the people of their own culture. According to Rosa (2010) different cultural groups have developed different ways of doing mathematics in order to understand and comprehend their own cultural, social, political, economic, and natural environments. I have a bit more done about this topic to change myself to transfer to give some touches to my research topic. I have envisioned this topic as my future direction in the field of research to do something to transform myself and to transform others in this study.

Citizenship mathematics education

We, human beings are creative, social animal and our life is connected to real world that everything comes together. As Keith Devlin notes, “the study of mathematics is ultimately the study of humanity itself (Devlin, 1998, 9).So, we may not separate mathematics from our day to day activities and other subjects. Similarly, if we believe that mathematics is harmless and innocent because it has little to do with the world we live in, then we might simply respond that mathematics education does not have a role in citizenship education outside of offering some form of mental stimulation or exercise for the mind. However, even the pure mathematics agrees that

mathematics is a part of our human experience (Davis and Hersh, 1981). So, the citizenship mathematics education which is teaching and learning, for all ages within and beyond school helps to upgrade academic excellence, inspired me to explore the present scenario of the country. The word "citizenship" means being involved in such activities as illustrated by "our community". According to (Skovsmose, 1998), citizenship can also be analyzed in more theoretical terms, one of these is "empowerment", another is Müdigkeit.[27] In my study, I have presented some glocal mathematics knowledge practices to address the citizenship education. I think about this issue is left to be well done in our country, so I take this issue as my future possibilities in my research field.

Curriculum and ethno mathematics

It is also my future vision to study. Our country is facing centralism when creating different curriculums. In my view, the curriculum maker, educationist probably cannot address of such diversity of language, caste, culture, regional problem and so on. Here, we consider ethno mathematics, which is used to express the relationship between culture and mathematics. In this regard , the term ethno describes characteristics related to the cultural identity of a group such as languages , codes, values, jargon, beliefs, food and dress , hobbits, and physical traits while the term mathematics expresses a broad view of mathematics, which includes ciphering, arithmetic, classifying , ordering , inferring, and modeling (D' Ambrosio,2001). As a learner, a teacher, a researcher, I have envisioned to work in this area thereby helping to design inclusive curriculum from ethno mathematics perspective to address local knowledge in mathematics and mathematics in local knowledge.

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[27] The German word Mündigkeit has a double meaning. The term relates to legal theory referring to a person coming of age and thus acquiring an adult's rights and responsibilities in society. However, the term also has an informal meaning: that of having the capacity to speak for oneself (Skovsmose,1998)

Learning mathematics through educational materials

Being a researcher, a teacher and a learner, I have envisaged learning mathematics through educational materials because I have got lots of knowledge on this topic from different seminars and training, shared my lived experiences which is activity based learning.

Collaboration in mathematics learning

"Collaborative learning "is an umbrella term for a variety of educational approaches involving joint intellectual efforts by students, or students and teacher together. Usually, students are working in groups of two or more, mutually searching for understanding solutions, or meanings, or creating a product. Teachers who use collaborative learning approaches tend to think of themselves less as expert transmitters of knowledge to students, and more as expert designers of intellectual experiences for students –as coaches of mid-wives of a more emergent learning process (Anne Good sell, Michelle Maher, Vincent Tinto, Barbara Leigh Smith and Jean MacGregor, 1992). So, as a mathematics teacher and researcher, what I knew is that we should teach about the context not the content which is my vision to study in future.

I would like to put some questions to myself. To my readers and researchers as did my reflection speak about the issue of my research problem? Can my approach of teaching and learning be helpful to improve our educational practices? Was I able to think the issue what I had presented? Was I able to connect local knowledge with school mathematics? Can local knowledge empower the learning mathematics? Is this a challenge in teaching and learning?

Lesson learned

In this study, I have reflected on my journey from childhood till now. I have presented my narratives and different images of my past life. Writing my narratives, I learnt about my weaknesses and strengths. The regular guidance and good suggestions from my supervisor made me to think different theories such as constructivist, social constructivist, and able to be constructivist teacher. Constructivist theory emphasizes on the pedagogical importance and focuses on the learner's cognitive and social meaning making process

(Kincheloe, 2004). Incorporation of glocal knowledge with school mathematics plays a vital role in mathematics teaching and learning process. In the beginning, I had a little knowledge about this. After this study, I have come to know that if the students' social and cultural values are encouraged and supported in the mathematics classroom teaching and learning 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). So, in this type of classroom, the instructional components should be as given below:

- Student collaboration as well as teacher collaboration to identify real world examples
- Interdisciplinary learning
- Student centered
- Active learning
- Use of informal and out of school knowledge i.e. local knowledge.
- Use of explicitly literacy strategies

- Authentic assessment

By following the above instructions, learners (students) will be empowered to learn more mathematics. However, some constraints play a vital role to be gone specifics. There still is not well introduced glocal knowledge in the current curriculum. To apply this kind of approach in teaching and learning, many challenges such as teacher motivation, new curriculum, methods of different assessment, parent and student expectation etc. are to be minimized by financial support from government, by changing educational policy and so on.

An epilogue

In the beginning stage of my thesis, I thought about how I could do the work properly. Feeling, it was first work to explore my auto ethnography inquiry under interpretive research paradigm, I started but lots of problem touched my heart as lack of English language, vocabulary, English literature, low typing skills. On the way of doing my work, many problems arose especially at home which is not important to share in this study. The environment of K.U. and facilitators' regular facilitating encouraged and empowered me to move ahead. Still, I remembered research facilitator's message, "*what a wonderful chapter! I like it very much*." Also, I remembered supervisor's words, "*The issue of the research and its design is excellent*." Inspired from these words, I began my thesis, and came to in this stage.

Whenever readers read a novel, a book, a drama, a story or a poem, they move with the sentiments and images described in the writings. At the same time, they also create some image about the writer after the reading is complete. I don't say that my study will change your (readers) whole thinking and my narrative episodes and get on the right track of learning mathematics. I think you, readers, have made certain pictures about me, and my research now. I don't want to claim that I have no

authorship but you possess more authorship than me as “I am encouraging you to make your own meaning out of my text” (Luitel, 2003, p.129 as cited in Koirala, 2007). At last, thank you all the readers.

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