A JOURNEY THROUGH DIFFERENT IMAGES OF MATHEMATICS CURRICULUM AND THEIR PEDAGOGICAL IMPLICATIONS: AN AUTOETHNOGRAPHIC INQUIRY

Laxman Luitel

A Dissertation

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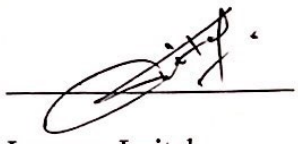
DECLARATION

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



February 02, 2020

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DEDICATION

To my grandparents (Late Hari Prasad Luitel and Late Pabitra Luitel) and my father Late Ram Chandra Luitel, who always stood up for my education, and because of whom I am here at this brighter phase of education.

To my mother Chitra Devi Luitel, beloved family members and relatives, mathematics teachers, teacher educators, curriculum developers as well as those who inspired me to move ahead along educational journey.

Master of Philosophy in Mathematics Education dissertation of *Laxman Luitel* entitled "*A Journey through Different Images of Mathematics Curriculum and their Pedagogical Implications: An Autoethnographic Inquiry*" presented on February 02, 2020.

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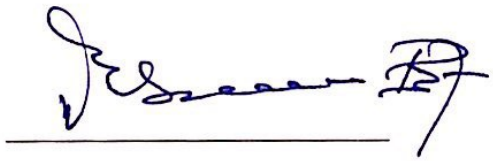

February 02, 2020

Prof. Mahesh Nath Parajuli, PhD

Dean/Chair of Research Committee

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

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ABSTRACT

An abstract of the dissertation of *Laxman Luitel* for the degree of *Master of Philosophy in Mathematics Education* presented at Kathmandu University School of Education on February, 2020.

Title: *A Journey Through Different Images of Mathematics Curriculum and their Pedagogical Implications: An Autoethnographic Inquiry*

Abstract Approved: _____

Asst. Prof. Binod Prasad Pant

Dissertation Supervisor

In my experience of teaching mathematics, I have been getting an opportunity to work together with the mathematics teachers from primary to secondary level as well as participating together in the training and workshop related to the uses and understanding of the mathematics curriculum. Correspondingly, as a student of mathematics, I have studied curricula and mathematics as a compulsory course in school life as well as university life. I was engaged in memorizing the definition of the curriculum instead of its practical implication. While doing so, I experienced that sometimes our curriculum serves the students' need and interest and sometimes does not, sometimes it become contextual and sometimes it does not. Sometimes it challenges the teacher's planning and activity design and sometimes it suggests incorporating more substances. However, as a student and a teacher, what I experienced and have been experiencing is textbook becomes the main source of teaching and learning. Planning is based on the textbook and mathematics curriculum is prepared by so-called 'expert' and is prescriptive in nature and is rarely applied in

teaching learning activities. In this regard, the purpose of this research was to explore and critically investigate my images of mathematics curriculum and associated pedagogy. Side by side, I have discussed assessment practice guided by different images of mathematics curriculum. To direct my research, I have constructed four different research questions and chosen paradigms of interpretivism, criticalism and postmodernism (Taylor & Medina, 2013).

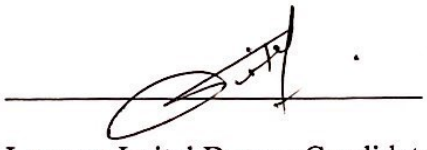
Embracing the multi-paradigmatic design space, I employed autoethnography as a research methodology and writing as a research method for portraying my narratives and stories. I used Knowledge Constitutive Interest (Habermas, 1972), Transformative Learning Theory (Mezirow, 1991) and Social Constructivism (Vygotsky, 1978; Ernest, 1991) as theoretical referents.

Mainly, I have divided this research into four sections to critically analyze dis/empowering images of mathematics curriculum. First, I have started my experiences of working with mathematical activities during my childhood when I did not start my formal education. Similarly, I have connected my informal mathematics to formal mathematics and official mathematics curriculum and constructed the images of mathematics curriculum as a textbook, curriculum as tools for testing human intelligence, curriculum as a list of contents, etc.

Second, I have unfolded my experiences of learning mathematics as well as a curriculum as a university student when I was a Bachelor level student of mathematics in college. The pedagogical approach was oriented by coding and decoding aspects which was focused on memorization of definition of curriculum, theorems, axioms etc. In this regard, the images of mathematics curriculum as cultural reproduction, curriculum as prescription, etc. were constructed.

Third, I have reflected on my initial experiences of teaching which was guided by my experiences of learning at school and college. I was busy implementing the component and essence of prescribed mathematics curriculum and became the Universalist as well as a foundationalist mathematics teacher. Curriculum as a textbook, curriculum as dollar-based document, curriculum as sequence of algorithmic problems, etc. were the constructed images of mathematics curriculum in which teaching was highly based on one-way narration.

Fourth, I have explained how I came up with the empowering images of the mathematics curriculum. In this regard, curriculum as experiences, curriculum as a collection of art, curriculum as an interactive way of teaching and learning, etc. were the constructed images of the mathematics curriculum, likely to serve the essence of *curriculum as cultural reconstruction, currere,* as well *experiences* discussed by Schubert (1986). I have offered empowering and humanizing pedagogy focusing on indigenous mathematical knowledge as well as integrated curriculum that might help to enhance cultural aspects of mathematic, respect global as well as local aspect of mathematics and foster equality and equity in educational institutions and society for bringing inclusive and transformative vision of mathematics and mathematics curriculum. In this context, on the basis of experiences of learning mathematics education at Master's as well as MPhil study at the university, participation in the conferences, workshop, seminar as well as interaction with students, I can argue that STEAM curriculum, as well as STEAM pedagogy, will be the appropriate to enhance the cultural aspects of mathematics, to value the students' experiences as well as to enhance the 21st century skills.



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ABBREVIATIONS

APA	American Psychological Association
BLE	Basic Level Examination
CBSE	Central Board of Secondary Education
CDC	Curriculum Development Center
DLE	District Level Examination
HSEB	Higher Secondary Education Board
ICT	Information and Communication Technology
KU	Kathmandu University
KUSOED	Kathmandu University School of Education
MPhil	Master of Philosophy
PhD	Doctor of Philosophy
SEE	Secondary Education Examination
SLC	School Leaving Certificate
SMIC	Science and Mathematics International Conference
STEAM	Science, Technology, Engineering, Arts and Mathematics
TPD	Teacher Professional Development
TU	Tribhuvan University
VDC	Village Development Committee

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CHAPTER I

INTRODUCTION

Education is a basic part of everybody's life. It is necessary for the development of an individual, family, society, nation and the whole world. Thus, education is the brain of any society and the backbone of any system (Jha, Adhikari, & Pant, 2006). Basically, people enroll in school to take formal education. Different curricula are being introduced in a structural way on the basis of designed discipline-based curriculum. It means that there is certain time to study each subject and different person are appointed as teachers who teach different subjects like mathematics, science, social studies, etc. Formative and summative assessments are in use to evaluate students' learning outcomes. However, summative assessment system is dominant in our school culture.

In such a context, mathematics is one of the subjects which is taught from the very beginning of school level. Initially, children are taught from basic skills of mathematics like addition, subtraction, multiplication, and division and later on its weight and length. The difficulty level of content has been increased grade-wise keeping into account the age level of students. In doing so, there are many resources like curriculum, textbook, teachers' guide, handouts, etc. which either enable or constrain the teacher and student to work inside and outside of the classroom. The curriculum is considered as an important source to make teaching and learning effective. It provides guidelines on what to teach and what not to teach as well as makes the educators aware of the teaching hours. Here, I mention the curriculum as a documented stuff because of my experience of teaching and learning mathematics in

school. My schooling was totally depended on the textbook and teachers' concern was to finish the course of every subject rather than fulfilling the objectives envisioned by the curriculum. Most of the textbook writers in Nepal, especially of school mathematics do not follow the curriculum in an effective way during the writing of the book. Instead of following the curriculum, even it is prescriptive in nature, their focus is on the complex and tricky mathematical problem. Thereby, they include unnecessary readymade problems which neither serve the objectives of the curriculum nor connect it to the learner's daily experience.

Further, most of the teachers, parents and other stakeholders have been oriented that mathematics textbook with heavy loaded content is effective and recommended to the students. Thereby, mathematics teacher mostly applies traditional pedagogy such as lecture method and transmission approach during teaching and learning mathematics as viewed by Panthi and Belbase (2017). The guiding principle of behaviorism enforced teacher as well as students towards a series of mathematical algorithmic problem solving so as to prepare themselves for the examination (Shrestha, 2018). Thus, examination driven teaching and curricula hinder students from learning through constructive ways as well as erode the creativity, imaginary, as well as innovative thinking, and thereby students become enslaved by the textbook.

Moreover, our teaching and learning activities in general and mathematics education in particular focus on preparing the learners for the final examination for the sake of so-called highest marks that make mathematics more unpopular (Lamichhane, 2019), thereby number of students of mathematics as well as mathematics education in higher education are decreasing year by year. Thus, one of the challenges for policy-makers and educationists today is to increase participation

levels and success rates within the study of mathematics (Macintyre & Hamilton, 2010).

However, teachers those who are using mathematics curriculum provided by Curriculum Development Centre (CDC) of Nepal rather than a textbook with revision and reconstruction on the basis of the context of school as well as students' specific needs and interest in day to day teaching activities might enable teachers to teach mathematics through constructivist approach. In my opinion, revision of prescriptive curriculum on the basis of particular context may enable the teachers to incorporate students' experiences, cultural activities through critical and problem-posing pedagogy. Imposing present mathematics curriculum without any revision on the basis of the classroom context, students' need and interest, etc. might kill the students' creativity as well as promote textbook oriented teaching and learning.

One of the reasons to less use of the mathematics curriculum in Nepali school might be its prescriptive as well as decontextualized nature. Thus, it seems to me as mentioned by Luitel (2018) that the official notion of the term 'curriculum' is a document that embodies objectives, a list of contents and some prescriptive teaching methods. In the context of Nepal, somebody who is in the post of Curriculum Development Centre (CDC) prescribes the curriculum to the teachers for the purpose of implementation inside the classroom like medicine prescribed by the doctors to the patient, but the teacher is neither a patient nor a prescriber. So, the mathematics curriculum of Nepal might not play the role as an antibiotic. Moreover, these situations enable the teachers as well as students to develop other different images of the curriculum like curriculum as subject matter, curriculum as content, curriculum as cultural reproduction, etc. as discussed by Schubert (1986). However, such types of

images of the curriculum in general and mathematics curriculum in particular rarely allow the teachers to construct a context-appropriate curriculum.

Constructing the Statement of the Problem

My experience of teaching mathematics at one of the schools inside the Kathmandu valley (during the academic session 2014/15) enables me to reflect my experience of learning mathematics. How my teachers taught mathematics and how I learned is superior to why I teach and what I need to teach. I was focusing on the readymade problem given in the textbook. Similarly, I frequently said to students, "Practice makes a man perfect" and forced them to solve each and every problem either it was for particular grade level and age level or not. I came to know about the curriculum, its elements as well as the curriculum theories, but I never directly implemented and used it in the teaching and learning process, thereby the mathematics curriculum has been replaced by the mathematics textbook. After joining Natural Garden school (one of the so-called progressive schools), I got an opportunity to work together with mathematics teachers from primary level to secondary level as well as participate together in the training and workshop related to the uses, understanding, and development of curriculum. Correspondingly, as a student of mathematics education, I have been studying curriculum and mathematics since the intermediate level of my study. While doing so, I experienced that sometimes our mathematics curriculum served the students' need and interest and sometimes it did not, sometimes it became contextual and sometimes did not, sometimes it challenged the teacher's planning and activity design and sometimes it suggested incorporating more substances. This is happening in our context because curriculum is considered as subject matter and centrally prepared document. These narrowly conceived views of curriculum are likely to restrict teachers from imagining and implementing creative

and empowering pedagogies. Furthermore, an experience of training helped me to emerge with this research agenda which has been discussed below.

It was a day of January 2018; we all the teachers were participating in a training related to the curriculum. Initially, we reviewed the national objectives of the curriculum. During the training session, the trainer was busy giving the instructions and the trainees were just following the instruction and carrying out some group works and activities. In the meantime, it was the first day of training, the trainer started explaining that curriculum is one kind of Hindu *Grantha*[1] such as *Veda*[2] and *Bhagavad-Gita*[3] which is prepared with certain beliefs and perceptions and have been imposed to human beings, with the beliefs that written things, philosophies, myths, etc. are true. Thus, arriving at this stage, I have constructed the images of mathematics *curriculum as stable document*. Similarly, majority of Hindu people till today are following numerous philosophies and myths as well as superstition. None of us are thinking about revision and rewriting them. To me, it does not mean that they are totally wrong and follow them but accepting those things with revision on the basis of time and context looks better. Further, the trainer mentioned "*Whatever has been mentioned in the curriculum, should be followed strictly and must be implemented to achieve the goals set in it"* This concept caught my immediate attention and made me thoughtful. I myself reflected on my experience of learning at University which started raising questions such as: does curriculum really a kind holy book of religion as the trainer said? I think that the trainer was promoted by the idea of 'one-size-fits-all' approach of the curriculum and pedagogy (Luitel, 2013), thereby wanted the

[1]used by Tamil Brahmans for the Sanskrit transcriptions of their sacred books.
[2]any of the four collections forming the earliest body of Indian scripture, consisting of the Rig Veda, Sama Veda, Yajur Veda, and Atharva Veda, which codified the ideas and practices of Vedic religion and laid down the basis of classical Hinduism.
[3]Song of God

trainees to choose the teacher-centered approaches of teaching such as traditional lecture method, he might as well be impressed with the view of "banking pedagogy" (Freire, 1993). Consequently, I myself was motivated to explore the images of mathematics curriculum and pedagogical practices of myself as a teacher, student as well as teacher educator. Similarly, after a few months, the same trainer trained me on the topic use of curriculum by introducing the curriculum as *Valid, Structure, Uniform, Reliable* and *Formation* (V- SURF) which is discussed below in detail.

Curriculum as V-SURF: Moving towards Structuralism

Accordingly, I got an opportunity to participate in the training on the curriculum with the same trainer as mentioned above. Initially, I felt regretful to participate in the training again with the same trainer on the same topic 'curriculum' in which I had already become disappointed in his session. However, as an MPhil scholar, teacher and teacher educator as well as taking curriculum and pedagogy as the major areas of research, I thought that the training might be effective to carry out my research smoothly. I started to observe his delivery during the training session as a researcher from one side and trainee from another side. Most of the trainees were new to him, thereby started by asking questions to the trainees such as: what do you understand about curriculum? Have you been using curriculum during teaching and learning process? etc. Most of the participants responded that curriculum is syllabus, curriculum is course of study, curriculum itself is a content, etc.

After a few minutes of discussion, the trainer displayed the colorful power-point to us. Aesthetically, the power-point was attractive, including pictures, frames as well as colorful words. The trainer profoundly appreciated the present school curriculum in general and mathematics curriculum in particular, thereby he first told us to read the national goals of curriculum which were displayed. The goal was quite

interesting to read. Later, he showed the slide that included curriculum as "V – *SURF"* (V represents *Valid*, S for *Standard*, U for *Uniform*, R for *Reliable* and F for *Formation*). The trainer encouraged us to read repeatedly and remember to say curriculum as *V-SURF*. Most of the trainees were listening and following his instruction amazingly. I wondered to see such kinds of thinking towards the curriculum which I ever heard and read the definition of curriculum in that way during my academic life at school and university. I reflected back upon my classes of master and M Phil at KUSOED, remembered Habermas's knowledge constitutive interest that I read in the course of curricula in mathematics education and tried to link it to technical interest which I have discussed in chapter II. The words like '*valid', 'uniform', 'standard', 'reliable'* and '*formation'* really touched me and raised many questions in me. Actually, how to measure either the curriculum (mathematics) is valid or not and who measures it? What signifies uniformity in curriculum? What actually is formation called in curriculum? and so forth. With those questions in my mind, I wanted to unpack my perceptions, beliefs, views and thoughts regarding mathematics curriculum. Unpacking those beliefs in/directly reflected and showed the pictures of how curricular and pedagogical practices, especially in mathematics education, are shaped, thereby opening the door to envisage inclusive and contextualized mathematics curriculum.

Lots of research studies are conducted by raising the issues related to mathematics curriculum, pedagogy and assessment in general and nature of mathematics, images of mathematics and mathematics curriculum, conventional pedagogy, etc. in particular. In this context, Fraser and Bosanquet (2006) examine the variation in perception of the curriculum of associate lecture and associate professors from Australian university. The semi-structured interviews were conducted to gain a

description of each participant's conception of curriculum. Four different categories of description emerged from the data, in which the curriculum is conceptualized as the structure and content of a unit (technical interest), the structure and content of a program of study (technical interest), the students' experience of learning (practical interest) and a dynamic and interactive process of teaching and learning (emancipatory interest). In addition, Luitel and Pant (2019) concluded their research with four different emergent curriculum images and they are *format used by textbook authors, the jack of all trades but master of none, students' experiences of learning, and interactive process of teaching and learning.* These images of mathematics curriculum were emerged after interacting and taking the narrative of three mathematics teachers of a Nepali institutional school. Finally, the authors argued that images of mathematics curriculum created by teachers play a vital role to incorporate the substantive and transformative pedagogies inside the classroom.

Moreover, as we are facing many problems in teaching and learning mathematics from school level to university level, scholars from Nepal are trying to highlight those issues via research article, dissertation, etc. In this scenario, Luitel (2009) pointed out the issues on the decontextualized nature of mathematics education faced by the students of Nepal, whereas more than 90 cultural groups interact with each other in Nepal. His auto ethnographic texts reveal with the ideas of inclusive and multidimensional image of the nature of mathematics as an impure knowledge system, a multi logical perspective, inclusive image of mathematics curriculum as montage, etc. from the hegemony of the unidimensional nature of mathematics as a body of pure knowledge, disempowering reductionisms in curricular and pedagogical aspects, narrowly conceived logics, uncritical attitudes towards the image of curriculum as a thing or object, narrowly conceived notions of globalization,

foundationalism and mathematical language that give rise to a decontextualized mathematics teacher education program. Accordingly, Shrestha (2018) critically explored re/examined, re/invented and reflected on his pedagogical practices with the aim of improving his own pedagogical practices and explored non/linear approaches of teaching and learning mathematics so as to envision holistic mathematics education. The researcher highlighted the problems of linear teaching and learning of mathematics due to the reductionism in Nepali mathematics education so as to seek possible ways of improving his pedagogical practices and envisaged inclusive, authentic a well as empowering mathematics education in terms of pedagogy and curriculum.

Above discussed research studies enabled me to conduct the research in new and burning issues related to the curriculum images in general and mathematics curriculum in particular. The above discussed research has been conducted to assess researcher's (and others) beliefs about the curriculum, pedagogy, and assessment which are helpful to improve their (others') practices. Moreover, they have been conducted to challenge the status-quo, rigid structure, as well as articulate conventional logics that act as a constraint to make mathematics and mathematics curriculum flexible and contextual. In addition, above discussed studies have been discussed in such a way which critically analyzed the de/contextualized nature of mathematics curriculum, pedagogy, and assessment with the help of narratives or stories. In my opinion, unless and until our mathematics curriculum is child-friendly, contextual, inclusive, then teaching and learning mathematics remain same as discussed by the other researchers as mentioned above. So, the demand of the present context is to examine the mathematics curriculum closely, and critique it for change.

In this regard, I am interested in my (as well as other's) understanding of prescribed and de/contextualized nature of mathematics curriculum and their implication. I explored the way I perceived the present mathematics curriculum and effective pedagogies on the basis of understanding the present mathematics curriculum. This study will be helpful to improve my practices as well as it might compel other teacher-researchers to be thoughtful enough and reflect on their own practices.

Purpose of the Study

The main purpose of the study was to investigate my understandings about the images of the mathematics curriculum in developing and applying different pedagogies in my practice as a mathematics teacher.

Research Questions

As indicated in the purpose section, I investigated my understanding of the mathematics curriculum while developing and applying mathematics pedagogies in my practices as a mathematics teacher and represent metaphorically. I felt it difficult to construct standard research question(s) to address the purpose of the study in which I have thousands of queries regarding mathematics education. Despite the lots of queries, I tried to respond to the following research questions through this study.

1. How did I develop different curriculum images of mathematics by interacting with daily life entities in early years of schooling?
2. How did I conceptualize the pedagogical approach in mathematics from the perspectives of different curriculum images as a university student?
3. How did I construct different disempowering images of mathematics curriculum and promote one-way narration pedagogy?

4. How have I been transforming towards valuing the progressive images of mathematics curriculum from conventional curriculum images?

Significance of the Study

This study presents my view about the present mathematics curriculum or it can give the picture of mathematics curriculum on the basis or both of our understanding during the dealing with curriculum. Similarly, it is likely to give the picture of pedagogical practices which is shaped by an understanding of the curriculum. Thus, first, it is useful for me to improve my practices as a teacher-researcher. A critical examination of my practices enables me to change. Second, it is likely to be useful for practitioner teacher because this research helps them to become aware of their practices as well as for teacher-researcher to find other similar kinds of issues for further research. Thirdly, it might be equally helpful for the curriculum designers to find out the drawbacks and revise the curriculum.

Delimitations of the Study

As an autoethnographic researcher, I took my academic and professional experiences as major sources of generating and constructing data text. While doing so, the experiences of people who are in/directly connected with me played a vital role to construct the data text. However, I unpacked my experience of working in the field of education in general and mathematics education, mathematics curriculum and pedagogy in particular.

Curriculum is taken as an important tool of teaching and learning process but in our context, nowadays it is replaced by heavily content loaded textbooks. Mathematics curriculum looks like a prescribed document prepared by certain groups of people those who are in the center, thereby pedagogy is chosen by the teacher does not serve the students' specific needs and interests as well as does not fulfill the 21st

century skills. Thus, in this research I critically analyzed the present mathematics curriculum and associated pedagogy through constructed curriculum images, thereby envisioned inclusive and contextualized mathematics curriculum in our context.

Theoretical Referents

Theories are important to shape my experience as a student, teacher, and teacher-researcher. Theories help to articulate experiences, narratives, and feelings of researcher-participant in a critical and aesthetic manner. Theories provide the right direction for the researcher to engage with the narratives and biography. Conventionally, theories in research are taken as a rigid framework and structure that has been bound by the research process that is guided by the positivist research paradigm. This is what I was aware of theories as frameworks, instead of employing the creative notion of theories as referents (Tobin & Tippins, 1993 as cited in Luitel, 2009). The idea of referents is associated with the view of the world through various perspectives. Moreover, I have used theory as referent to view the world (in my case, curriculum images, pedagogical practices, assessment, etc.). Thus, I have used some theories (transformative learning theory, knowledge constitutive interest, and social constructivism) as referents rather than a framework in this research.

Knowledge Constitutive Interest

The theoretical referent I have employed in my research is Habermasian knowledge constitutive interest (1972). This theory talks about how knowledge is constructed. From the Habermasian point of view, human interest is grounded in rationality. Each interest (technical, practical, emancipatory) given by Habermas is rooted in human beliefs, thoughts and expressed in a particular type of inquiry (Pant, 2015). It means that knowledge constructed by the human is shaped by the human interest in which these interests play a role directly or indirectly.

The technical interest is a view that knowledge is beyond human existence. It is a more product-oriented type of interest. Those people oriented to the technical interest created the fixed knowledge which is always the same and see the context in a single way. Moreover, the teacher guided by the technical interest implements the curriculum and students' learning is controlled so that at the end of the teaching process, students can be judged in terms of how well they achieved the unit or program goals (Fraser & Bosanquet, 2006). It is the belief that controlled environment helps to construct the knowledge where no open discussion, communication, and interaction exist. Thus, beliefs of the curriculum that are outlined by people who are technically oriented are documented, subject matter is fully delivered inside the classroom, and knowledge is shaped by the prepared and readymade problems/content where there is no place for changing or modifying the context. Assessment system and pedagogy are rigid. In such a context, a teacher plays an active role to transfer the knowledge.

Practical interest is about understanding the context,raises the people's voices and moves ahead for meaning as well as decision making. It gives the value to the knowledge constructed by the multilingual and multicultural students. Practically oriented people do not take the curriculum to be a fixed content and subject matter. They give value to the students, society, their experience and practices in the curriculum and develop teaching pedagogy accordingly. Students participate in communication, sharing, and discussion to construct the knowledge which is in context. Grundy (1987) suggests that students are the subjects of the curriculum, not its objects and content are selected for the purpose of assisting meaning-making and interpretation, and are likely to be holistically oriented and integrated. There are more

formative types of assessment in which presentation, journal writing, unit test, etc. are the criteria for evaluation.

Moreover, the teachers oriented by the practical interest are also the researchers of their own practice, with the skills and communication to study their own teaching and test the theory in practice (Kemmis & Fitzclarence, 1986 as cited by Fraser & Bosanquet, 2006) and teacher with a practical cognitive interest is concerned that interactions in the learning environment provide appropriate opportunities of learning (Fraser & Bosanquet, 2006).

The emancipatory interest given by Habermas talks about autonomy and responsibility. It means that the learners, policymakers, and other stakeholders tend to be autonomous while creating knowledge. Being autonomous does not mean that they forget their responsibility. Autonomous is taken in the sense of independence from the created dogma. Similarly, it talks about equity and justice. According to Kemmis and Fitzclarence, (1986, p. 72) “emancipatory interest strives for empowerment, rational autonomy, and freedom, emancipating others from false ideas distorted forms of communication and coercive forms of social relationship which constrain human action” (as cited in Fraser & Bosanquet, 2006). Thus, this interest focuses on active participation of learners where learning experience should be meaningful to the learners based on question pedagogy. The curriculum should be flexible with the aims of intellectual empowerment. Thereby, I have used emancipatory interest in this research to develop awareness on the false consciousness which is a new form of hegemony, on the various episodes of my lives as a student, teacher and teacher educator.

Thus, taking knowledge constitutive interest as referent helps me to contextualize the data text theoretically and gives me a kind of permission to discuss

the human culture, their beliefs and practices differently. Moreover, from the viewpoints of knowledge-constitutive interest, I tried to become conscious of various dis/empowering forces that were forcing us for a longer time and attempted to visualize better changes in teaching and learning in an artistic form.

Social Constructivism: Co-construction of Knowledge

Ernest (1991) mentioned that social constructivism views mathematics as a social construction and it plays a key role in establishing and justifying truths of mathematics. Thus, it believes in fallibility of the nature of mathematical knowledge. Moreover, mathematical knowledge and thoughts develop and change on the basis of time and context. Ernest (1991) further explained that social constructivism is a descriptive one as opposed to a prescriptive philosophy of mathematics. Thus, mathematics or mathematical knowledge is not a kind of medicine which is prescribed by the physician, but it is a kind of human thought invented during the self-study, communication and educational discourses.

Social constructivism is a useful theory for me to understand how I constructed my own beliefs system towards mathematics curriculum, pedagogy and assessment in different stages of personal and professional life. I used this theory to understand how belief systems are formed during the engagement with the mathematical text, curricular manuscript, pedagogical ideas as well as communication with different non/professional people. Similarly, it also gave me a theoretical reference to describe the deep-seatedbeliefs, taken for granted ideas of human, myths and their construction. I have used the social constructivism to argue that the images of the curriculum as well as pedagogical practice shaped by those images are not fixed but it depends solely on the culture, society and human thoughts which are different and unique.

Transformative Learning Theory: Awareness for Transformation

Mezirow (1991) mentioned that it is essential for learners to become critically reflective of the assumptions, underlying intentions, values, beliefs, and feelings. It means that transformative learning theory does not only help in reflective practice but also helps to critically reflect our beliefs and practices. That reflective practice is the way of looking back and 'critically reflective' practice is the process of identifying what is convincible and inconvincible. In this context, Taylor, Taylor and Luitel (2012) mentioned that transformative research involves a way of critically examining our personal and professional values and beliefs to explore how our lifeworld has been governed by in/visible sources/forces of the society. Thus, transformative learning theory enables me to critique and examine my practices in mathematics education that might be helping me to transform my pedagogical practices and curriculum-making process from decontextualized situation to contextualized situation. Similarly, Taylor (2013) has mentioned that "researchers as transformative learners draw on constructivist, critical, social and arts-based epistemologies to examine reflectively, critically and imaginatively their lived experiences revealing the historical and sociocultural framing of their personal lives and professional practices" (p. 2).Transformative learning theory is very useful to me for critically examining on my practices of using and engaging with the mathematics curriculum as well as teaching and learning approaches, assessment, etc. One of the purposes of taking this theory as referent in this research is to make sense of my various professional experiences reflecting critically on the taken for granted assumptions underpinning my own and of the values of other as mentioned by Pant (2015). Thus, this research provides me new lens of looking, new ways of doing and new ways of thinking about myself and the world.

Moreover, in my research context, it suggests engaging in critical reflective practices to revisit my experiences, exploring my present practices and pondering on future orientation to bring desirable changes in our institution and community (Lamichhane, 2019). Keeping everything in my mind, transformative learning theory enables me to unfold my experiences critically and envisioning alternative inclusive and transformative views of mathematics education. As a transformative teacher, teacher educator and researcher of mathematics education, I always try to improve my practices through reflective practices, communication, revealing my past and present experience through narratives in which transformative learning theory provides space.

Chapter Synopsis

Chapter 1: On the basis of my academic and professional experiences, chapter 1 explores the research problems of my research highlighting the issues of the mathematics curriculum. Moreover, this chapter articulates how my research problems are embedded in my professional lifeworld, in which I have discussed previously conducted research related to the mathematics education, curriculum and pedagogy. Apart from this, the purpose of this study as well as research questions have been presented accordingly with my theoretical referents.

Chapter 2: This chapter articulates how multi-paradigmatic design space as well as autoethnography as methodology, fits well as per the nature of the research problem. Moreover, based on writing as a method of inquiry, ways of data text generation as well as meaning making process have been discussed.

Chapter 3: How everyday mathematics is isolated from the school mathematics curriculum has discussed through critical analysis of my formal and informal education. Moreover, I have discussed and analyzed the present mathematics

curriculum based on the images of the mathematics curriculum as a tool for testing human intelligence, curriculum as content and textbook as curriculum.

Chapter 4: This chapter articulates the images of mathematics curriculum that I constructed during my study of higher secondary level and Bachelor level. Based on the constructed images of mathematics curriculum, this chapter depicts how learning mathematics was like recording and memorizing. I have also used poetic logic and genres to analyze my autoethnographic texts.

Chapter 5: This chapter portrays my first experience in teaching mathematics. Encountering the images of mathematics curriculum as foreign language, dollar-based text, sequence of algorithmic problems; I critically analyzed the parental view of mathematics curriculum as textbook. Moreover, I discussed pedagogical practice as one-way narration guided by the above-mentioned curriculum images.

Chapter 6: The main essence of this chapter is to discuss progressive images of the mathematics curriculum. I encounter the images of mathematics curriculum as lived experiences, collection of art, etc. based on my experiences of working at so-called progressive school as well as participating in the education expo. Moreover, participating in the conferences as well as workshop enabled me to portray STEAM-based mathematics through STEAM-based pedagogy. Moreover, I argue from the indigenous knowledge point of view on mathematics rather than western/Eurocentric knowledge.

Chapter 7: The journey of this research just stops with this chapter having opened a new chapter of my life. This chapter reveals my learning throughout the research journey. More specifically, I have reflected on the changes I have realized in my heart, mind and soul while identifying the research issues, preparing research questions, selecting research methodology, unpacking experiences of different stages

of my life as a teacher, student, teacher educator, researcher, etc. despite lots of difficulties and challenges. Moreover, the qualitative map of my preferred mathematics curriculum images might be thoughtful to teacher, teacher educator, students as well as curriculum expert and policy makers.

Key Message of the Chapter

In this chapter, I have described how my research agenda emerged by pondering and immersing within my academic and professional journey of mathematics education. I was really thoughtful during the training session related to the curriculum in general and mathematics curriculum in particular. Indeed, participating in those training sessions opened the door to conduct this research. After describing the events of emergence of my research agenda, I have discussed the purpose of this study, research questions, rationale and delimitations of this study respectively. I have formulated research questions which have enabled me to ponder on my images of curriculum in general and mathematics curriculum in particular of academic and professional journey of my life. Moreover, I have reflected on the pedagogical practices, to some extent assessment system based on the curriculum images. Similarly, I have analyzed the previously conducted research in the area of mathematics education, thereby prepared the initial roadmap of my research. In addition, I have discussed three educational theories with their applicability throughout this study. Finally, I have concluded this chapter by discussing briefly the chapters which are constructed based on different contexts and scenario.

CHAPTER II

RESEARCH METHODOLOGY

In this chapter, firstly I have discussed some philosophical understanding of this research. Secondly, I have discussed the multi-paradigmatic research approach through interpretivism, criticilism and post-modernism. Thirdly, I envisioned autoethnography as a research methodology of this research and writing as a method of inquiry. Finally, I have discussed quality standards and ethical issues of the study.

My Philosophical Underpinnings

There are certain philosophical underpinnings which I have discussed below which comprise of axiological, epistemological, and ontological, assumptions and they deal with the nature of reality, ways of knowledge construction and understanding as well as a value system. In addition, these all are helpful enough to portray the reality of research, knowledge construction and values.

Axiological Consideration

The axiology of the research focuses on how the researcher's values, thoughts and beliefs are associated with the research. Gouldner (1970) mentioned that research can never be value-free (as cited in Taylor & Bogdan, 1998). Generally, a value determines how we present our outcomes and how perceive data text. So, as autoethnographic researcher my views, thought, experience, etc. may influence the outcomes of the research. While doing so, my axiological assumption has been developed through the relativist ontology and inter-subjective or constructivist epistemology.

Thus, my role in the research was not only of the researcher but also the research participant. I presented my lived experiences through multiple ways such as narratives, stories, dialogue, etc. to uncover my images of mathematics along with curriculum and pedagogy as well as assessment. In addition, I have explicitly/implicitly expressed my lived experiences from my perspectives that have been rooted by socio-cultural, academic and professional values. Moreover, I value my own experiences and refection on the experiences. Thus, the axiology of this was value-laden which enabled me to take change-seeking, transformative and post humanist (i.e. post-formal) axiology in my research as/for professional development.

Epistemological Consideration

Epistemology focuses on the nature of knowledge. It is concerned with what we can know about reality and how can we know it (Willis, 2007). Thus, the main concern of epistemology in this research is the way of understanding the mathematics curriculum by myself (and others) in multiple ways. Moreover, this research concerns with how I perceive and describe the mathematics curriculum as well as how it is shaping my pedagogy. In my context, what I experienced and understood about the mathematics curriculum during interaction with teachers, educators, etc. presented images of mathematics curriculum throughout the research journey in different ways, especially based on the philosophy of constructivism. Therefore, I believe that mathematical knowledge is created and constructed through human activities for the fulfillment of their lifeworld and intellectual requirements.

Thus, I believe in constructivist or subjective epistemology in which acknowledged multiple ways of knowing basically depend on human traits. Construction of knowledge as well as understanding the context depends on the humans' cognitive, affective as well as psychometric activity. However, the

objectivist epistemology describes the pure mathematical knowledge which is absolutist and certain, whereas subjective or constructivist epistemology describes fallibilist and is constructed through human activities, experience and interaction. While not rejecting the earlier (absolutist) epistemology, I subscribed to fallibilist epistemology in my research.

Ontological Assumptions

Ontology is concerned with the nature of reality or existence and talks about reality (Willis, 2007). Thus, the ontology of this research is relativism. The aim of this research was to explore and critically assess my images of mathematics curriculum and pedagogical practices. Those images with regard to mathematics curriculum are different and shaped by different contexts. Further, realities also depend on the context as well as situations. It does not mean that I deny the objective knowledge, but my standpoint here is largely subjectivity.

In my view, the mathematical reality is constructed through human interaction and experience. Thus, the relativism of ontology in this research enabled me to value the human activities and experiences which are likely to be different from person to person.

Research as/for Transformative Professional Development

The qualitative approach of the research method is one of the exciting and novel methods for engaging in decolonizing and reconstructualising their society's curricular and pedagogies policies and practices (Taylor, 2013). With an agreement to this statement, I engaged deeply with myself on my own experiences of using curriculum during the teaching and learning process. That enabled me to defend the colonized ways of curriculum development. Transformative research is a multi-paradigmatic approach as/for professional development as a means for becoming

change agents (Taylor, Taylor, & Luitel, 2012) and for the purpose of ensuring that mathematics education contributes to sustainable development.

In this context, as a means for change agents means the research was focused on the transformation of the policies, critique of the practices, existing structure and process of curriculum development as well as teaching and learning of mathematics. Similarly, for the purpose of sustainable development means that this research might "meet the needs of present generation without compromising the ability of future generations to meet their own needs" (United Nations General Assembly, 1987, p. 43 as cited in Emas, 2015).

Further, research as a transformative professional development enabled me to deconstruct the hegemonic grip of the Western modern worldview on my everyday practices as a basis for envisioning culturally inclusive mathematics education (Luitel & Taylor, 2019). Many researchers considered that researchers as transformative learner, develop personally and professionally. For instance, Rahmawati (2019) mentioned that she adopted the role of researcher as transformative learner as she reflected on her teaching, research practice, teaching identity and envisioned her future pedagogical practice as a transformative teacher educator in her doctoral research. In this context, as a transformative researcher, throughout this research journey, I critically reflected on my curricular and pedagogical practices and represented metaphorically which helped me to envision better curricular as well as pedagogical practices.

Multiparadigmatic Research Study

One of the challenges faced by any researcher is how to move along overall research journey or how to accomplish the task on time because of the lack of enough knowledge and ideas about the research, lack of roadmap of the research or lack of

clear vision or purpose of the research. In fact, enough knowledge and ideas about the research, and the roadmap of the research with clear vision or purpose of the research have to be well articulated. In this context, multi-paradigmatic research (Taylor, Taylor, & Luitel, 2012; Taylor, 2013) design enabled me to construct and deconstruct my beliefs, practices and thought in multiple ways. Moreover, I adapted paradigm of interpretivism, paradigm of criticalism and paradigm of postmodernism. Some paradigms that I discussed below enabled me to excavate and narrate my experiences, whereas other paradigm also discussed below enabled me to be more conscious regarding the past and present practices of mathematics curriculum and pedagogy by raising critical question, to envision for better practices. Further, I have elaborated in more detail about those paradigms, focusing on how I have used them in my study.

Paradigm of Interpretivism

An interpretive research paradigm is mostly used in a research field that promotes humanist agenda. According to this paradigm, the researcher is engaged with participants for a prolonged time. There is more interaction, interviewing and understanding of the other's culture as unfolding other and self-understanding. One of the main purposes of the interpretive research is to find the subjective kind of knowledge, knowledge of the experience of teachers and students and the cultures of the particular context. Thus, epistemology of this paradigm is inter-subjective knowledge construction (Taylor & Medina, 2013), thereby this paradigm always seeks to give the answer to 'how' questions.

The paradigm of interpretivism focuses on exploring the context-based subject meaning that helps to uncover the personal beliefs, values, perspectives and actions in association with his/her socio-cultural milieu (Bryman, 2012). Methodologically, my research agenda explored my own experiences about the curriculum in general and

mathematics curriculum in particular in the Nepali context which demands subjective interpretation. Thus, interpretivism enabled me to understand and generate the meaning of life-world experiences. Furthermore, I tried to capture the essences of my thoughts, feelings, pleasure, beliefs, and values from my own perspectives (Taylor, Taylor & Luitel, 2012). While doing so, I articulated the beliefs, understanding, as well as views of others of specific things being deeply immersed with/in the life-worlds of the subject, institutions, stakeholders who are around with me. Moreover, interpretivism enabled me to create the meaning of culturally dis-empowering and decontextualizing mathematics curriculum and pedagogy in which I presented through different logic and genres. Furthermore, interpretivism enabled me to explore my life-world experiences that ultimately unfolded my images of mathematics curriculum and pedagogy, thereby I deeply engaged in reflecting my prior and present activities through dialogue with professional communities, stories, interpretations and flashbacks of my experiences (Taylor & Medina, 2013).That prolonged engagement with myself (as well as others) enabled me to construct intersubjective knowledge related to the education system in general and mathematics education in particular.

Paradigm of Criticalism

The paradigm of interpretivism is not enough to deal with my research issues such as disempowering images of mathematics curriculum and pedagogy, I explored my critical voices and hence I needed the ideas of criticalism to see the injustices that we are facing in our learning contexts. In this type of research, the process of writing as an inquiry has an added critical dimension and becomes a means of critical analysis and ideology critique of established policy and practices (Taylor & Medina, 2013). Thus, as a researcher and participant, I critiqued my own practices, why and how it happened, whose interest influenced to be superior. Moreover, critiquing present

mathematics curriculum on the basis of constructed images of mathematics curriculum and pedagogical practices is another dimension of this research.

Paradigm of Postmodernism

This paradigm of research provides multiple ways of representation. Criticalism and interpretivism are not enough research paradigms in this research to represent my experiential text. One of the tasks we can do in research is to represent our thoughts and feelings through various means of communication like language, art, and dance, gesture (Taylor & Medina, 2013). Thus, different focus of representations, such as poems, metaphors, narratives, pictures, etc. could be articulated as a representation of rich narratives which serves the art-based approach in research. Moreover, the methodology- autoethnography-that I have selected here to conduct the research is itself a postmodernism approach.

Autoethnography as Methodology

There are several ways of constructing, representing, and perceiving knowledge. This equally depends on the researcher as how s/he understands the context or phenomena. I believe on non-positivist or reformative paradigm, who believes in multiple realities, subjective knowledge, sees the context from multiple ways and interprets as well as represents it in multiple ways. A transformative researcher, who looks to the society or context from diverse lens and always seeks to transform the society from one paradigm to another. Also, the transformative researcher plays a role of a bridge between the values and norms of human and research.

So, in my context, as a transformative researcher, I chose the methodology of my own interest that serves the purpose of non-positivist knowledge. Choosing the research methodology depends on the researcher's interest, background, and research

topic or context as well as concerns on how the researcher problematizes the situation and the purpose of the research.

My interest is to understand the same things in multiple vantage points and represent those through various approaches such as story, narratives, poem, dialogue, pictures, etc. Thus, I have chosen the methodology that serves the non-positivist paradigm.

I used autoethnography as a research methodology in this research. My interest was to investigate upon my academic experiences, critique those experiences, make myself as well as others aware, and transform from one paradigm to another. I have used autoethnography as research methodology means, I have examined my experiences in the context of emerging and ever-changing relationships and enter the world of others as much as I try to understand self (Admas, Jones, & Ellis, 2016). I examined and critiqued upon self-experiences to transform myself. Transforming myself means looking for alternative practices in my profession, works, in this changing world. In this context, I agreed with Mariana (2017) as she mentioned that "to be able to transform others, you should be able to transform yourself, by being able to transform yourself, you have to know and understand who you are, and what is your real self because any transformation will initially be happening inside you" (p. 1). Thus, among various research methodologies, I realized that autoethnography could be the best fit for me. I have located myself through others' eyes and heart, considered their alternative points of view and interpretations and tried to feel their difficulties as I could (Admas, Jones, & Ellis, 2016). Thus, throughout the research journey, I took my experiences, feelings and emotions as a center of the research that occurred from the interactions, communication, and collaboration with my peers, colleagues, family, and friends.

Moreover, autoethnography is known as insider's methodology where the researcher's personal and professional experiences become the key basis of the inquiry (Luitel, 2009). In order to achieve this, the researcher uses the principles of autobiography and ethnography simultaneously. So, this is a process of a reflective self-examination by an individual set within his or her cultural context (Creswell, 2012). Thus, autoethnography is much concerned about the researcher and his/her background as a major source of problem identification and development of research question. In this regard, it comprises of three words -auto (self), ethno (culture), and graphy (study) with the aim of textual representations of one's personal experiences in his/her cultural context.

Autoethnography as a form of inquiry, writing, and/or performance that puts questions and "issues of being" into circulation and dialogue (Bochner, 2016). I have used autoethnography as not only an aspect of methodology, method but also a genre of my inquiry. Further, autoethnography focuses on work of "my", also to focus on the experiences of others (Ellis, 2017). Thus, I have used the notion of autoethnography as an insider's (as well as outsider's) methodology in which my (as well as others' personals and professional) experiences become the basis of inquiry. Writing autoethnography with others or using autoethnography as a research methodology with others is a practice of deeply relating to body, heart and word (Admas, Jones, & Ellis, 2016). The nature of my research oriented me to explore my lived experiences during the interaction with others regarding curriculum in general and mathematics curriculum in particular as well as pedagogy that has been groomed by mathematical culture of Nepal. This research methodology enabled me to focus on cultural beliefs, perceptions, values and practices of mathematics curriculum and pedagogy that have been reflected on my experiences. Moreover, it became helpful

for me to recall and critically analyze my past and present experiences regarding mathematics curriculum and pedagogy, thereby helps me to create the road map for future purposes. So, one of the purposes of subscribing autoethnography research methodology was to become imaginative, critical and reflective thinker which in/directly helps to transform myself as well as others.

Moreover, autoethnography empowered me to create the relationship between my past and present experiences, myself with others, etc. writing narratives and stories. Autoethnographers turn to the narrative and storytelling to give meaning to identities, relationships, and experiences and to create relationships between past and present, researchers and participants, writers and readers, tellers and audiences (Admas, Jones & Ellis, 2015), thereby brings to understand who I am with others. So, the narrated text, stories, poem, etc. throughout the study depend on the interaction with myself as well as with others those who are working in the field of education in general and mathematics education in particular. Stories are the ways that I (we) make sense of my (their) worlds, and stories are essential to human understanding and are not unique to autoethnography (Ellis, 2004). In addition, my research has been guided by an autoethnography methodology with the use of my experiences as a student of mathematics education, mathematics teacher and teacher educator in Nepal. Thus, an autoethnography methodology contributes (especially in this research) to the view that reality is constructed through the portrayal of researcher's (my) experiences in a cultural context (Spry, 2018). Expressing my lived experiences through deep-engagement in the ongoing cultural activities throughout this research enabled me to cultivate the new and personal ways of knowing that could emancipate from 'one size fits all' approaches (Admas, Jones, & Ellis, 2015). During excavation of upon my experiences, I came to realize that autoethnography methodology in research is one of

the flexible, emerging, and contextualized research methodologies in social science, thereby researcher critiques and analyzes the false consciousness which is shaped by in/visible source of society. So, it plays an important role to develop and grow professionally.

Moreover, as I mentioned above, as an autoethnographer, to understand my self and to evaluate my works, I have always taken others' voices, questions, beliefs, and thoughts in the center of the study. Considering others' voices and thoughts enabled me to know who I am and what my position is. In this context, Spry (2018) mentioned that "autoethnographic works often conceptualize the other for the purpose of understanding self" (p. 1094). Thus, representing other's self throughout the study through narratives, stories and dialogue enabled me to understand and critique the socio-cultural and political practices as well.

Writing as a Method of Inquiry

The main purpose of this research was to explore my images of mathematics curriculum and associated pedagogies and envision alternative, inclusive and transformative mathematics curriculum. For this, I have investigated upon my own practices and reflected critically through the autoethnography research methodology. In this regard, among the various methods of inquiry in social science research, I chose writing as a method of inquiry that represents my experiences, work, thought, expressions, etc. through interpretive, critical, and postmodern way. In this context, Richardson and Pierre (2018) mentioned that writing as a method of inquiry is a viable way to learn about themselves and the research topic. In autoethnographic research, writing provides insights to the researcher to learn about themselves and others which play the role of a mirror.

Moreover, Pierre (2018) discussed that writing is thinking, writing is analysis and writing needs a seductive and tangled method of discovery. Thus, writing has different dimensions for inquiry, for instance, it helps in the process of inquiry through thinking, by analysis and it becomes a method of discovery if a researcher thinks about the seductive and tangled method of discovery during the writing process. Writing as inquiry allows for deeper reflection on the sequence of events in an individual's life. Those reflections help the researcher to critique and challenge the practices.

Further, styles of writing are neither fixed not neutral but rather reflect the historically shifting domination of particular schools or paradigms (Richardson, 2018), thereby I did not prepare any format and structure of writing. However, writing as a method of inquiry enabled me to explore my lived experiences and they are about myself, my workplace, discipline, friends, and family which were associated with me from my childhood to till now. Throughout the study, I have created stories, narratives, dialogue and poems through writing and conceptualized the different images of mathematics curriculum. Moreover, writing as a method of inquiry helped me for the re/interpretation and the meaning-making process by relating key essence, events, and turning points of my experiences with the contemporary discourses of mathematics education that gave the holistic pictures of mathematics education practice of Nepal (Lamichhane, 2019). Further, collection of data text and meaning-making process throughout the research went together being engaged deeply in mathematical and socio-cultural practices. In this regard, I agree with the statement stated by Pierre (2018) that data collection (generation) and data analysis or meaning-making process cannot be separated when writing is a method of inquiry. Thus, I first generated or explored my lived experiences of educational and professional journey

and then focused on restoring my story and narratives relating with larger socio-cultural, political scenario and intellectual discourses.

Strategies of Narrative Generation

Autoethnographic way of construction of the data in this study involves the process of unpacking my own beliefs about the teaching and learning (Montgomery, 2007) in general and teaching and learning mathematics in particular. I have incorporated my beliefs and thoughts as well as the perceptions of mathematics curriculum and pedagogy, thereby unfolded its impacts on my professional journey, on the basis of my teaching and learning of mathematics. My reflective journal regarding mathematics curriculum and experiences of implementing mathematics curriculum enabled me to construct the data text throughout this research. Using writing as a method of inquiry, throughout the research enabled me to construct and co-construct my past and present experiences in the form of narratives, stories, dialogues as well as poems.

Further, during data text or narrative generation, I always tried to answer the question such as why do people, as well as myself, behave the way I (we) do? How am I affected by the events (related to mathematics education) that go around me? How and why has culture (in the field of education in general and mathematics education in particular) developed in the way that I (we) have? etc. Keeping these questions in my mind, I have generated the data text on the basis of my experiences of doing mathematics with/out formal mathematics curriculum, doing mathematics during schooling, during my college and university, during my teaching, etc., thereby I worked with those data text to develop the concepts of mathematics curriculum and pedagogy that I experienced and have been experiencing to explore the practices of mathematics education in our context. Thus, the data text or narrative that I have

generated throughout the research is subjective, descriptive, naturalistic as well as inductive.

Interpreting and Meaning Making Process

As an interpretive researcher, I went beyond the positivistic mode of thinking such as hypothetico-deductive logic and representation during the meaning-making process. I accredited the interpretivism, criticism, and post-modernism as my research paradigms for unpacking my images of mathematics curriculum and pedagogy. On the basis of those research paradigms as well as methodology of autoethnography, I tried to connect textual data or my experiences with wider range of community in general and wider range of mathematics community in particular. Regarding the meaning-making process or data text analysis in qualitative research, Perakyla and Ruusuvuori (2018) mentioned that by reading and rereading researcher's empirical materials, the researchers try to pin down their key themes and thereby draw a picture of the presuppositions and meanings that constitute the cultural world of which the textual material is a specimen. Consequently, as a qualitative researcher, I did not have any predefined protocol to execute and analyze my data text.

However, I have used various logics and genres while writing a narrative and analyzing data text. Those logics and genres have allowed me to create knowledge as well as represent my views or logic in a comprehensible way. Moreover, those logics and genres enabled me to connect the research and readers. While thinking about logics and genres, I was influenced by the three-research logic in my multi-paradigmatic research. I have used poetic logic, metaphorical logic, and narrative logic.

Metaphorical Logic

Metaphorical approach is another way of understanding curriculum in general and mathematics curriculum in particular that might be descriptive or combination of descriptive and perceptive. This approach works beyond the definitional approach of curriculum. Nowadays metaphor is used as a common language in everyday communication. It is pervasive in everyday life, not just in language but in thought and action (Lakoff & Johnson, 1980). Thus, metaphor is used to understand 'A term' in terms of 'B term.' More specifically, the essence of metaphor is understood and experienced in one kind of thing in terms of another (Lakoff & Johnson, 1980). In addition, metaphorical representation enables us to express our personal, academic as well as professional experiences more precisely and clearly. For instance, *school as garden.* Here, the '*garden*' metaphor enables us to understand the school in which teacher as *gardener* and the students as *flower or plant.* Thus, metaphors are culturally constructed constructs that provide rich insights to certain ideas/practices

Thus, metaphorical way of understanding mathematics curriculum enables teachers and students to link the mathematics curriculum into different contexts experienced by the teachers and students. In this context, I agree with the Lamichhane's (2019) views that main feature of conceptualizing the personal experiences regarding curriculum practices and pedagogical approaches with the help of metaphors is to incorporate the reflective thinking and experiences. Thus, metaphorical thinking helps educators to incorporate the experiences in day to day classroom through reflective, critical as well as imaginary thinking. Further, a metaphor implicitly compares two domains of experience called target domain and the source domain. For instance, if teacher is understood as a *gardener*, the work of a teacher is the *target* domain; gardening or policing is the source domain. The ground

is the idea of creating suitable conditions for growing but it is just different between human and plants.

Arriving at this stage, during unfolding of my professional and personal experiences, I have used metaphor as a tool for meaning-making, thereby readers can easily connect to their context. Moreover, metaphorical logic was used to explore meaning of concepts and ideas, otherwise they would remain hidden in the narrowness of literalism (Luitel, 2009).

However, the idea that explains how metaphors are linked with bodily experience is the notion of *image schema* (Johnson, 1987, p. 28 as cited in Parzysz, Kadunz, Robotti & Rogers, 2007). A schema is a recurrent pattern which occurs in a person's cognitive activities; image schemata are images associated with such patterns and order in action, perception, and conceptions (Parzysz, Kadunz, Robotti & Rogers, 2007).

Moreover, images refer to broader and complex constructs emerged from human experiences. In this scenario, Sam (1999) mentioned that images of mathematics or mathematics curriculum are a mental representation of something which is in/directly associated with conceptions, attitudes, and beliefs that are evolved through the social interaction and past experiences. Thus, during the interaction with the people of society regarding mathematics and mathematics curriculum, different images can be constructed on the basis of their cognitive, affective as well as psychomotor aspects of learning and understanding. Affective domain refers to the human attitudes, feelings, and emotions, whereas cognitive domain reflects beliefs, as well as knowledge of mathematics and mathematics curriculum and psychomotor domain refers to interaction with the peers, teachers, larger group of community members, etc. In the philosophical encyclopedic dictionary, an image is designated as

the form of the reflection of an object that takes in human consciousness (Solonchak & Pesina, 2015). Thus, simply images of mathematics curriculum and pedagogy refer to the understanding, sense-making, idea-generating, etc. and it can vary in the minds of different individuals as each individual is different. However, the different modes such as images and language enable us to construct metaphors. Thus, in my opinion, images and metaphors are not too much separated from each other. In this context, Bolognesi (2018) mentioned that typical metaphors expressed through words and images might be constructed on the basis of different types of features, which are shared by the metaphorical term.

Narrative Logic

Narrative logic pays greater attention to the distinctiveness of narrative as human activity, the particularities of narrative inquiry, and specific ways that narrative inquiry promotes social change (Chase, 2018). In this research, I have used narrative logic as the main source of showing my thoughts about the mathematics curriculum and pedagogy and that might motivate readers to change their pedagogical as well as curricular practices. Narrative and narrative logics enabled me to represent the data text in the storied form which would be of interest to the reader as well as easy to connect with their experiences. Narrative logic encouraged me to be attentive towards emotions, feelings, nonverbal communication, and possibilities for dialogue and community (Chase, 2018). Similarly, it enabled me to show the multiple meanings of the same concepts and contexts.

Moreover, I took the entrenched meanings of my narratives with the larger context of mathematics education through my reflective writing, non-textual imaginary and dialectical excavation of experiences. One of the strengths of narrative inquiry in this research was to explore my lived experiences through a focus on my

personal narratives, often revealing aspects of lives previously hidden from or suppressed by social science (Chase, 2018). More so, the narrative presented throughout the research study might facilitate readers for engaging in my narratives and their conscious interpretations relating to the other-self (Denshire, 2013). The narrative presented throughout the research was constructed on the basis of my academic and professional life. Moreover, the continuous interactions and communication with mathematical society and immediate environment also supported me to relate my images of mathematics curriculum as well as pedagogy to broader social-cultural and institutional practices.

Dialectical Logic

Like other logics, as I discussed above, dialectical logics enabled me to represent the dialectical relationship between something opposing ideas and concepts throughout the research journey, especially for the purpose of meaning-making. For this, I used the symbol '/' to represent such relationship. For instance, de/contextual, learn/teach, etc. The main purpose of articulating dialectical logic is to minimize contradictions imbued in 'either-or' dualistic logics by encouraging synergistic and balancing views (Wong, 2006 as cited in Luitel, 2009). Thus, this logic minimizes the dualistic and exclusive thinking of mathematics, mathematics curriculum, and pedagogy via more general and comprehensive.

Moreover, I used the symbol '*/*' for indicating the dialectical connection between the constructs throughout my writing, thereby it showed that my argument was not blended for un/favoring specific vision or concepts. I believed in interdependency and co-arising knowledge system rather than dualistic and binary logic of knowledge or reality (Luitel, 2009), thereby I tried to reflect on my voices, emotions, feelings and alternative visions of mathematics incorporating the dialectical

notions of different views from the fundamentalism to the postmodernism that helped in better mathematics in the context of Nepal (Lamichhane, 2019).

Poetic Logic

As I have chosen the different ways of interpretation and explanation, poem or poetic logic is one of them. Furman (2006) argued that poetry in particular has become a valuable tool for qualitative researchers and many researchers have used poetry as a means of data text representation by arranging data from qualitative interviews into line and stanza breaks. Further, Taylor and Medina (2019) mentioned that poem in a research serves a legitimate function as both the process and product of the contemporary qualitative research. Thus, poetic logic in qualitative research enables researchers to present their experiences in more authentic way. Moreover, as a transformative researcher, I want to develop my skills, seek opportunity, develop good moral values, etc. through research, thereby poetic logic could be one of the best genres to develop my personal as well as professional strengths. Taylor and Medina (2019) mentioned that "transformative research is about touching lives: touching the lives of students and at the same time students' lives touching ours" (p. 53).

As a transformative researcher, taking this statement as a reference, poetry in this research (see chapter V) could touch the lives of the readers and play the role of positive change in their practices. Moreover, I have used poetic logic to express "ineffability associated with my visions" (Luitel, 2019, p. 28) as well as it helped me to be less presumptive, open and inclusive towards different view of mathematics, pedagogy as well as assessment.

Quality Standards

Quality standards represent the nature of each paradigm with respect to judging the quality of research. It is different from just holding the existence of the

truth and the role of researchers. For example, in post/positivism, it represents the world with observed truth and objectivity through systematic procedures. On the other hand, interpretivism describes the meaning of the world with different facets of truth which involves the subjectivity of the researchers. On the basis of the paradigm I have chosen, I maintained credibility, transferability, pedagogical thoughtfulness, and authenticity as quality standards in my research.

Verisimilitude as Likeliness

Eills (2004) mentioned that autoethnographic text achieves the quality of verisimilitude as it evokes a feeling that the experience described is lifelike, believable, and possible (as cited in Pant, 2015). Thus, the reader will be engaged in the stories, narratives by asking questions such as 'Do the setting, events, and people in the vignettes sound believable?'

Thus, to maintain this standard in my research, I provided a rich description of my and others' experiences and detailed information about the place and participants involved in my stories, conversation, and narratives.

Critical Reflexivity being Reflective Practitioner

Brookfield (2005) mentioned that critically reflective practice is a process of inquiry involving practitioners to discover, and research the assumptions that frame how they work. Thus, criticalismin enabled me to be critical and visionary in my and others' practices towards curriculum, and pedagogical practices. To maintain this standard in my research, I acted as a reflective thinker by examining my and others' personal, and professional beliefs towards mathematics curriculum and teaching and learning process.

Further, Brookfield (1998) mentioned that critical reflective practitioners explore the assumptions that frame their work by seeing practice through the lens of

their own autobiographies as learners of reflective practice, the lens of learners' eyes, the lens of colleagues' perceptions, and the lens of theoretical, philosophical, and research literature. Therefore, to maintain this standard, I reflected critically upon my assumption as a researcher, process of interpretation visible to readers and critically reflected upon my and others' subjectivities (Luitel, 2013). Being critical and imaginative might empower readers to envisage better alternatives.

Transferability as Achievability in another Context

Transferability is about the usefulness of the research in similar another educational setting (Pant, 2015). Thus, my incorporated story, narrative and reflection can be used in somebody else's educational research. The idea of transferability is not to replicate the entire research process, rather it is about the adaptability a research aspect in a new context. As I used stories, vignettes, conversation and dialogue of my lived experiences throughout the study believing that they evoke readers, which could be teachers, teacher educators or even researchers. Further, I chose this to maintain the quality standard because the finding and discussion of the research may be relevant to other people who are in the field of education in general and mathematics education in particular.

Pedagogical Thoughtfulness as Evoking/Provoking Readers

According to Van Manen (1991), pedagogical thoughtfulness is more likely to demonstrate an understanding of another person in a particular circumstance and pedagogical thoughtfulness seems to be a reflective capacity. Thus, it is a process of realization of own practice in terms of others' practices. It means that findings, data text, narrative etc. from the research are helpful in rethinking the pedagogical practices of the reader. So, to maintain this standard in my research, I have tried to make findings and discussions of this research as materials for teaching and learning

activities of the readers and researcher. Luitel (2009) suggested that “pedagogical thoughtfulness is about increasing the likelihood of the teachers and teacher educator becoming aware of the deep-seated assumptions guiding their beliefs” (p. 55). I have attempted to address this quality standard in my research by bringing the real and strong images of mathematics curriculum and their role during pedagogical practices that can be helpful for teachers to follow or avoid in upcoming days in a storied/narrative way.

Ethical Standards

Ethics in the research is very important for the researchers. Ethics plays a crucial role to complete the research on time with a better understanding for the readers. Ethics of the researcher depends on the research issue and participant or researcher ethics can be different owing to the different research issues and participants. According to Bryman (2012), ethics in research involves how we should treat the people with whom we conduct research. Thus, maintenance of a good relationship between researcher and participants depends on the ethics of the researcher. In this context, Miller and Brewer (2003) suggested that ethical responsibility is essential at all stages of the research process, from the design of a study, including how participants are engaged, how they are treated through the course of these processes, and values of their participants.

As an autoethnographic researcher, I have used self as an authentic source of information through my life experiences, stories and epiphanies. Thus, I have tried to avoid the issues (such as being self-indulgent, narcissistic, introspective and individualized) that can occur in qualitative research in general and autoethnographic research in particular for making research more viable and trustworthy.

As an anautoethnographic researcher, I narrated my life story immensely related to the mathematics education practices in our context. I also tried to articulate my lived experiences and stories making them more culturally relevant based on natural setting. Consequently, I have used unbiased languages against gender, ethnicity, caste, professions, etc. throughout the study, thereby I am conscious about the beneficence, harm and anonymity and respect for every voice and identity.

Furthermore, the ethical standards I have maintained in my research also include negotiation and securing access (McNiff & Whitehead, 2006) and taking care of my vulnerability with those of others by pseudo names with whom I work and represented them as different characters in my narratives (Qutoshi, 2016).

Key Message of the Chapter

In this chapter, I articulated my philosophical assumptions based on ontology, epistemology, and axiology which represented how I came to adopt the qualitative approaches for navigating my research. Similarly, I mentioned how multi-paradigmatic research paradigms supported me to explore my lived experiences. As a teacher educator, researcher, I have discussed how research enables us to transform our self and our profession from one paradigm to another. Furthermore, I elaborated how and why I used autoethnography as research and methodology and writing as a method of inquiry. Finally, I explained how I made meanings from my writing (stories and narratives) and ways of maintaining the quality standards of my research work abiding by ethical practices.

CHAPTER III

MATHEMATICS WITHOUT FORMAL CURRICULUM TO MATHEMATICS TEXTBOOK AS CURRICULUM

In this chapter, first of all, I have discussed how I spent my childhood by doing different mathematical activities without formal or official mathematics curriculum. I have tried to portray my learning of mathematics with my parents, sisters, and peers through games, play, day to day work, shopping, and so forth. Whatever activities were done inside or outside of the home with parents, relatives, friends and neighbors matter a lot to understand school education in general and mathematics education in particular. Second, I have unpacked my learning experience of mathematics at school. While doing so, I have discussed my learning experience of mathematics based on mathematics curriculum, pedagogy, assessment, belief system of teachers towards mathematics, society and myself. I have tried to show how informal mathematics is hidden from school mathematics and readymade problems given in the textbook were dominant. As a researcher, I have represented my understanding of mathematics curriculum based on my learning experience via different metaphors that help reader as well as myself to connect the mathematics curriculum to different aspects such as textbook, content or subject matter, etc. Mainly, I followed the critical self-reflection which supports critical autoethnography to portray my understanding which is one of the main elements of transformative learning based on the research question: How did I develop different curriculum images of mathematics by interacting with daily life entities in early years of schooling?

My Colorful Childhood: Mathematics without Formal Curriculum

Figure 1

Let me start my journey of research by unfolding my passion for mathematics. I lived with my mother and sisters in the remote area (figure 1) of Nepal, which is located in the eastern part of Nepal. The main occupation of the people was agriculture. Diversity of people and their cultural with mathematically rich activities were one of the attractions of the village. Unknowingly, those mathematically rich cultural activities helped people to develop the mathematical skill day by day. Very few people took formal education. However, because of lack of awareness, when I was 4/5 years old, my elder sister taught me mathematics beginning with counting the numbers. My sisters were the second persons who got the responsibility to care for me and teach. My father made my sisters educated helping them to complete the school education and passed away while I was around five years. They had a main challenge to teach me and prepare me for school education, although they got support from my uncles and aunt. Before getting the formal education from school, I learned about counting of numbers, simple addition, subtraction, etc. during the interaction with my relatives, friends and other known and unknown persons. Those who came to my home frequently asked about my schooling and raised some questions related to multiplication table of different numbers, simple addition, subtraction as well as divisions such as $2 + 2 = ?, 15 - 12 = ?, 2 \times 4 = ?, etc.$ I also responded easily to their questions like $2 + 2 = 4, 15 - 12 = 3, 2 \times 4 = 8, etc.$ On reflection, why did they focus on mathematics? Why not questions from other subjects like social studies, Nepali, science? Why did they not tell me the story related to addition and subtraction? Every evening before going to bed and every morning after having food I

did something related to mathematics which was guided by my elder sisters. Sometimes, they gave me the mathematics textbook used by them during their schooling. I wondered to see old mathematics textbook was still like a new one. The pages were still spotlessly white, the pictures included inside the book were clear and visible. I was amazed to see the book cover which was like the cover page of recently bought book.

As a researcher, I came to realize that people often think mathematics is represented through the routine problems through textbook, and needs to reproduce same mathematical problems to coming generation. They suggested me doing addition, subtraction, multiplication, and division (as shown in the figure 2) on the book as well as forced me to copy the mathematical problems given in the book to solve. The people gave due importance to mathematics textbook and the readymade problems mentioned in it. On reflection, why did they not create their own mathematical problems related to their daily activities? Why did they not promote creativity as well as imaginary thinking in mathematics and why were they so much interested or focused on readymade problems solving?

1) $7 \times 8 =$	7) $5 + 8 =$
2) $9 \times 5 =$	8) $10 + 2 =$
3) $12 \times 7 =$	9) $15 - 15 =$
4) $11 \times 1 =$	10) $12 + 1 =$
5) $8 \times 1 =$	12) $11 + 0 =$
6) $10 \times 3 =$	13) $19 - 10 =$

Figure 2

However, it may not be my fault. I just tried to adjust the beliefs of the society towards education system in general and mathematics education system in particular to become mathematically literate as well as to support the culture created by the people of the society in which, the culture is shaped in such a way that promotes to think that mathematics is created by the people of Western countries and prescribed

us. Thus, I liked to solve problem given in the book rather than the work given in the exercise book. The mathematics problems were as shown in the above figure. They were abstract, symbolic, no context as well as not related to daily activities. Even, it was not related to any cultural events.

My Daily Routine: Engaged in Mathematically Rich Games

Figure 3

During my childhood, I woke up early in the morning. I took milk and biscuits and sometimes beaten rice. Once my elder sister gave me a mathematical problem as shown in the above figure and gave mathematics book of grade one, I enjoyed looking at the picture and doing mathematical problem given in it. I had lunch. I looked around and started to cry when I realized that my young sisters (uncle's daughters) were not around. Most of the times, I played with them as their ages were similar to mine. We played the game together. It was one of our traditional games known as *Ghati katte.* At least, two players were needed to play and we played turn by turn. For this, we drew eight rectangular boxes on the ground and a small piece of stone was needed, in which two of the rectangles were big and divided it into two equal rectangles as shown in the figure 3. We just estimated the area of a rectangle to make it equal. To play this game, the players (we) threw the stone into one rectangle and player had to jump into different boxes trying to get the stone, go through the end and come back again. The player had to start throwing the stone number by number. Similarly, sometimes in my childhood, my uncle took me to the traditional domestic animals' market as well as my mother took me to the shop for my clothes. I observed the way they

Figure 4

shopped. They bargained the prices all the time with the shopkeepers. I loved to accompany them to spend our family's limited money, and I was happy when we went back home with nice clothes, domestic animals (goat, cow, etc.). It seemed that we had successfully done our shopping.

Moreover, I remember now the game of marble simply called *Ghuchcha*[2] (see figure 4) that I used to play with my small sisters and friends. Marble is small spherical toy made from glass, clay, steel, plastic or agate. These balls vary in size. Most commonly, they are about 1cm in diameter. However, to play this, we need to make hole on the dirt area. So, the players (we) need to put the marble inside the hole by throwing from the distance around 2 meters away. Sometimes, one who won the game got the marbles from opponents or that was based upon the rules created by the players (us). I still remember how we prepared the hole (as shown in the figure inside circle) in appropriate size to play marble, how we estimated the distance between hole and the position of the player. However, I loved playing marbles. Every time I counted the marbles and made more than 20 pieces. Keeping marbles inside my pocket motivated me to count from 1 to the completion of the marble. Sometimes I won the game so that I had many marbles and sometimes my opponents won so that I had few marbles. However, to make more number sometime I bought from the market, sometimes borrowed from friends and I rarely collected. I used to be happy to have more marbles in my pocket.

While reflecting upon mathematical rich games which I frequently played during my childhood, some questions and queries arise my mind which make me thoughtful; was mathematically rich game as we played included in school mathematics curriculum. How do the people from society develop mathematical skills used in daily life activities? Who created those mathematically rich game which is

really funny? Why are those people not in the place of development of the school mathematics curriculum?, etc.

Now I realized that mathematics played an important role during my childhood. Unconsciously, I learned mathematical skills such as measurement, concept of near and far, more or less, short or long, estimation, etc. and applied those concepts informally whilst playing and shopping. In an informal way, I learned mathematical symbols and operations with the guidance of my uncle, mother as well as sisters. However, I did not realize that mathematical symbols and operations were related to my playing and shopping time. Also, I could not repudiate that my habit of practicing traditional games assembled my understanding of mathematics. I learned these as "the embodiment of local wisdom" (Pranoto & Hong, 2014, p. 71 as cited in Mariana, 2017), such as freedom of expression, a sense of friendship and togetherness whilst dealing with important conceptual issues (Mariana, 2017). Besides these, the game I played depicts the process of hard work and shopping with my parents that represents different mathematical operations in a real situation. Unfortunately, I could not find these traditional games, which are mathematically rich presented in our textbook as well as the mathematics curriculum. Likewise, I could not find the mathematical problem embodied in our daily activities.

Arriving this stage as mathematics teacher educator and researcher, remembering the above discussion or looking retrospectively my childhood, I want to construct the images of mathematics as (language) game in which unknowingly I learned mathematical skills through it using mathematical language. In this context, I remember the paper written by Stephen Lerman (1990) entitled Alternative Perspectives of the Nature of Mathematics and Their Influence on the Teaching of Mathematics. Actually, I came to know that fallibilism or fallibilist nature of

mathematics leads teachers and students or other stakeholders to move beyond the algorithm, routine problem, rote memorization, whereas absolutist nature of mathematics talks about mathematics as particular, fixed, certain, value free and abstract. Lerman (1990) highlighted that the mathematician and philosopher Wittgenstein's philosophy of mathematics as a "language game" might be the source of fallibilism. Arriving this stage, I realized that whichever games I played during my childhood, whatever dialogue and communication I heard during social activities (I participated with my parents during shopping) were mathematically rich and played and have been playing an important role in my life. On reflection, what type of mathematics curriculum is required to incorporate those mathematically rich games in the classroom? What types of pedagogies are essential? etc. One of the major challenges of mathematics teacher, educators and policymakers is to think and reflect upon the question that I raised above.

Textbook as Curriculum: Promoting Bookish Mathematics

My formal educational journey started around in 1998 AD from a rural private school in Nepal. The school was nearby my house. It was made of wood and the roof was of steel. Initially, I did not have many friends to go to school. My elder sister took me to school. My small sister (uncle's daughter) also went with us. I still remember my schooling as well as mathematics classes. At that time, in the ruler area of Nepal, there was lack of mathematics teacher. Now a days also the same situation might have been faced by the institutional school management in the rural areas of Nepal. The school management hired one mathematics teacher form Darjeeling, India. He used to teach us mathematics till grade 5 from grade 1. I remember the bamboo stick and the

Figure 5

covered mathematics textbook of his hand. How did the teacher save the mathematics textbook? I was amazed! He covered the mathematics textbook with a nice book cover having the picture of Bollywood film actors. We were also forced to do the same. He said, "*You need to use this book for a whole year, also it would be better to handover this book to the junior while you upgrade in another grade".* But nobody such as teachers and parents care what is inside the textbook. By supporting the ideas of Luitel (2018), I had difficulties of understanding the textbook language, the language of authors – that was very different from our day to day language. I thought that he was reproducing the school culture of Darjeeling. The mathematics teacher's voices represented how people believed towards the mathematics textbook and how the people reproduced the same thing again and again as there was no mathematics outside of the textbook. But why did people not think about the basis to prepare textbook, sources to prepare as well as the process to select the content?

It was any day in April 2002. It was around 8:30 am. I packed my school bag, kept the books, copy, pencil, etc. and finally, I got ready to go to school with the weight of four/five kilogram in my bag. It took around ten minutes after walking to reach school. It was my second day of grade four. Most of the times, I spent introducing with my new friends and new teachers. Suddenly, the bell rang. We stayed for the assembly in front of school. After completing the assembly, all of us moved to our respective classes. Our class was nearby the staff room so we quietly took our place and started to talk to each other in a whispering voice. Some of my friends were roaming around the class and some of them were doing homework. Suddenly, the teacher came to teach us Nepali subject. She was also our class teacher so she maintained our records of each and every work of all the subjects, events and frequently talked to our parents. We spent our Nepali class by reciting the poem,

telling a story, etc. However, the teacher told us to write one page of handwriting related to Nepali literature. The first period we enjoyed a lot. Our second period was mathematics. As the teacher said the day before, everybody was getting ready with book and exercise book as well as a pencil, eraser, and sharpener. The teacher came with a mathematics book in his one hand and few chalks, a stick and a duster in his next hand. He became happy to see the mathematics textbooks on the table in front of each student. Some of us were still searching for something in the bag. He was angry because we three did not have mathematics textbook. Unfortunately, we forgot the mathematics book at home. Because of these, we were punished and kept outside of the classroom.

The above discussion portrays how much the teacher gave importance to a mathematics textbook. Teachers' perception of textbook as the mathematics curriculum continues to encourage the splitting view of the value of the mathematics curriculum. In our context, teachers in general and mathematics teachers in particular still have the misconception that textbook serves as a framework that helps teachers think about what is to be taught as well as how will be taught. The textbook was full of exercises related to addition, subtraction, multiplications, division, etc. that I experienced in primary grade. Besides these, I have some queries, was it impossible to prepare the worksheet instead of following the bookish problem? Was it not possible to create a story, poem, like in Nepali class? Was it problematic to conduct the mathematical quizzes and the group works? The situation of the class was like whatever inside the textbook that was true and needed to follow in which mathematics was not outside from the book. So, I was habitual to learn mathematics by copying the questions in my exercise book from a textbook. The punishment that I got on the very second day always forced me to keep my mathematics book in my bag whole year

while going to school. I learnt by heart the numbers from zero to hundred as well as the multiplication table up to 12 clearly given in the textbook. I did not experience using any kind of concrete materials such as base ten blocks, Cuisenaire rods, tangram or any other local materials to learn about the numbers as well as geometrical shapes. But, remembered the marbles that I used to play at home which was effective to develop the concept of multiplication and addition as well as division and subtraction. Was it impossible to bring concrete materials such as base ten blocks, Cuisenaire rods, etc. to develop number sense as well as to learn addition, subtraction, multiplication, and division?

In such a way, I completed around six months of grade four from a private school. Because of the political instability, the private schools remained closed. Thus, I got enrolled in grade four again in a government school (figure 5) which was nearby my house and my previous school. The number of students in government school was more than in the private school I was before. The infrastructures were better in the private schools than in the government school. The mathematics teacher in government school was from the same village and used to talk in the Nepali language, whereas the private school's teacher was from Darjeeling and used to speak in English. Besides those differences that I experienced on the very first stage of my schooling, the way of mathematics teacher entering the classroom was almost the same. There also the teacher came up with a mathematics textbook and the bamboo stick. Those who did not follow the textbook properly got punished with a stick. In such a way, I completed my primary education. However, I memorized mathematical ideas, mathematical operations, numbers name, multiplication table and drew different shapes such as triangle, rectangle, circle, etc. during my primary education either through the memorization or minimal conceptual activities. Either those

moments were happy or sad, I would have been happier if I had been assigned to count marbles, cattle of the nearby farm or cattle shop, to observe from windows, door, and temple which have been around the school.

After completing my primary education, I got enrolled in grade six at the same school. Initially, I was amazed to see the number of students in grade six. There were almost 70 students which were about 5 times of grade five. Actually, there were nine wards in my Village Development Committee (VDC), one primary school in each ward and there was only one secondary school. Only one secondary school served all the students those who completed primary education from nine primary schools. I became happy to see many students because I thought the mathematics teacher might not be able to check or it would be difficult for him or her to identify the students those who did not bring the mathematics textbook. We might save ourselves from the punishment like in my previous grades. While I was at end of the lower secondary level that was at grade eight, I was forced to practice more mathematical routine problems. In grade six and grade seven, I had just one mathematics textbook to practice but in grade eight I had more materials to practice such as, guide, guess paper, textbook of different authors and publication etc. Parents, teacher and everybody were worried about District Level Examination (DLE) which was taken in grade eight for which question paper was brought from the district headquarter. My teacher and my relatives those who experienced DLE told me that the question did not come outside from the ‘exercise’ and ‘example’ so that I was forced to practice the readymade routine problem, memorize the formula, theorem, etc. I frequently saw the table of content, syllabus and kept on practicing accordingly. In such a way, I completed grade eight and nine. After getting enrolled in grade ten, the teacher used to give more emphasis on textbook and oriented me to solve the mathematical

problems from the textbook as well as other resources related to textbook such as ‘guess paper’, ‘solution set’, ‘guide book’, etc. One of the reasons to promote the value of a textbook is the School Leaving Certificate (SLC) exam. They used to say: All the questions of mathematics in the exam are asked from the mathematics textbook, solution set, question bank, etc. so your score in mathematics depends on your blind practice to solve the mathematical problems from those sources.

Arriving at this stage, I came to realize that the images of mathematics curriculum as textbook were likely to promote the images of curriculum as content or subject matter discussed by Schubert (1986). As I mentioned above, teaching and learning process is based on the textbook and limited to the topics given in the textbook. Teachers are busy completing the course and students keep following the teachers’ instruction. Whatever content is mentioned matters a lot in teaching and learning process rather than the knowledge constructed by the students. Ideally, the associated pedagogy of this metaphor is teacher-centered in which teaching is taken as a kind of transmitting the knowledge which leads the students not to develop as imaginative and creative thinkers.

Moreover, so-called curriculum experts are responsible to select the content and develop the curriculum. The curriculum prepared by the experts is prescribed to the teacher, and the student as its consumers. Content and subject matter-oriented mathematics curriculum enables teachers as well as students to develop absolutist thought, thereby adopt the transmissionist pedagogy. The epistemologies of the absolutist thoughts are subject to the standard rules, algorithms, and hypothetico-deductive procedure in which the students are asked to seek single right answer.

You Are Not Intelligent Enough to Learn Mathematics!

Who is known as intelligent in mathematics? Perhaps those who solve the mathematical problems properly, those who finish the exercise given in the textbook quickly, those who score good marks in a standardized examination or those who link the mathematics in his/her daily activities? In the context of Nepal, terminal examinations or end semester examinations are the most powerful assessment tools to assess the students' learning achievement which is taken every three months or six months or at the end of the academic session. Such kinds of examinations determine whether the learner is capable of upgrading in another grade or capable of learning mathematics. Not only this, most of the students in our context are victims of nicknames (name tag) on the basis of their performance (score in exam) in mathematics. As I discussed above 'textbook as mathematics curriculum', following narratives portrays how teachers talk about students' intelligence or how teachers measure students' intelligence based on the performance in the examination in which, examination is taken based on the routine problems of the textbook.

It was a day in April 2007, I was waiting for the result of District Level Examination (DLE) which was taken in grade eight before one month. Around 10 am, I came to know that the result was published. Because of the rural area of Nepal, school management was not able to provide the result on the same day. There was no internet facility and only few people had mobile phone. Everybody was in a hurry and anxious to know the result. Next morning, my friend came to my house and told me that the name list of passed students was being pasted on the notice board of the school. I was afraid. If there was not my name, then what would I do? I raised those questions to myself. My parents, relatives, friends as well as teachers were expecting my good result. There was not the grading system but the students were categorized

as the first division holders, second division holders, third division holders and pass on the basis of obtained marks in all subjects. I thought I scored any one of the first three positions. But after seeing the result my name was in the 5th number. Later, I came to know that lower marks in mathematics was the reason for the securing 5th position. I was scolded by some of the teachers as well as parents and they forced me to work hard in grade nine and ten in mathematics. After a few days, I joined grade nine. The teacher asked everybody to choose subject among mathematics and economics as an optional II subject. I was interested in mathematics so I chose mathematics as optional II in which education was compulsory for all as an optional I. So, we eight students among 35 decided to take up mathematics as an optional II. Next day, we went to another room for optional mathematics. The teacher had already been there. Everybody greeted the teacher. Initially, the teacher was interested to know our marks in mathematics at grade eight. Among eight students, we three had lower marks in mathematics. After knowing that, teacher's face became gloomy and said "It could be better if you took economics as an optional II subject. The class has not started yet. You may change. I have experienced that many students were not able to pass the School Leaving Certificate (SLC) because of the optional mathematics, even they failed in grade nine". Because of the lower marks in mathematics in grade eight, we were compelled to take economics as an optional II subject in secondary school. The teacher had in/directly focused on our less intelligence in mathematics and forgot that the three hours' examination was not able to assess the learner's capacity and ability to learn and the teacher totally believed in the mathematical problems given in the textbook only. Arriving at this stage, as a practitioner teacher researcher, I developed the notion of images of *mathematics curriculum as tools for*

testing human intelligence in which testing intelligence is rooted to the paper pencil test.

Besides the teacher's value towards the academic intelligence, some questions came to my mind. Did the marks obtained in the examination determine the persons' academic intelligence to learn mathematics or other subjects? The system of examination in Nepal contains problem solving, calculation, proving the theorem, etc. However, examinations driven intelligence is guided by the factory model of school in which mathematics curriculum as subject matter becomes the key. The factory model of schools achieves social control at the cost of intelligence, in which academic intelligence is broadly understood as problem-solving, critical thinking, and creativity as well as memorization and calculation (Pinar, 2004), thereby textbook is the center of learning. The teachers look like factory workers. Teachers are trained to manage and control the classroom to prepare the children for the examination.

Mathematics teachers are guided by the factory model school and curriculum forgetting that the children have multiple intelligences, different children can learn through different ways. The students have been victimized like me as discussed above. Also, they might be forgetting that intelligence is shaped by educational and cultural practices. In this context, the theory of Multiple Intelligence (MI) developed by psychologist Howard Gardner in the late 1970's and early 1980's, suggests that individuals possess eight or more relatively autonomous intelligences (Davis, Christodoulou, Seider & Gardner, 2011). Because of the multiple nature of intelligence, the ways of doing the same things or understanding the same concepts and cultures are different from person to person even the goal is the same. Here, the intelligence developed by Howard Gardner incorporates linguistic intelligence, logical-mathematical intelligence, spatial intelligence, musical intelligence, bodily-

kinesthetic intelligence, naturalistic intelligence, interpersonal intelligence, and intrapersonal intelligence (Gardener, 1999 as cited in Davis et al., 2011). The student's intelligence is not only measured or checked by the paper-pencil test which has been taken at the end of the year. In this 21st century, most of the school teachers either mathematics or other believe in the paper pencil test and level the students as intellectual, talented, intelligent, etc. on the basis of the performance in the examination. The examination depends on paper and pencil in which students need to complete the examination question within three hours. Normally, question paper is prepared including routine problem taking textbook as the main resource. However, the students' intelligence to learn mathematics depends on their classroom culture, teachers' behavior, home environment, culture of the society, etc. Teachers who do not want to review and modify the mathematics curriculum as subject matter based on students' specific need and interest, school as well as classroom culture depend only on the textbook and give more priority to paper pencil examination.

Further, teachers' beliefs and perceptions towards intelligence as academic productivity might be shaped by the use of textbook or thinking curriculum as a textbook and their experiences of learning mathematics. They are habitual to solve the problems without knowing the students' ability as well as students' need and interest from the textbook and they wish same for the students. While doing so, they forget that students have different stories and they come from different educational and cultural contexts. Moreover, on reflection, does the grade eight score on mathematics decide to learn optional mathematics in grade nine? Are these requirements mentioned in the optional math curriculum? Why additional mathematics is needed form grade nine? Why is it not in grade eight? Are the mathematical contents included in the optional mathematics enable people to run their daily activities?

The disempowering and demotivating thoughts towards the mathematics curriculum (as subject matter, textbook, etc.) assessment (as conformity what has been memorized), etc. allow teachers as well as students to promote solving mathematical and routine problems inside the classroom and check students' ability, capability or intelligence to learn mathematics. Moreover, such thinking promotes the privileged groups of students, whereas the marginalized group of students (low achievers, students form the Nepali language as second language, etc.) do not get the opportunity to learn as they wish. I mean to say that, thinking textbook as curriculum might not allow teachers to use differentiated instruction inside the classroom for diverse students. Differentiated instruction states a systematic approach to planning curriculum and instruction for academically diverse learners (Tomlinson & Eidson, 2003) rather than talking about the performance of mathematics or any specific subject in previous grade. In addition, teachers should reflect themselves upon the questions as mentioned by Tomlinson and Eidson (2003) what matters most here. What is the subject really about? What will be enduring value to my students? What must I share with them to help them truly understand the magic of the subject in their lives rather than blaming the students based on the performance of previous grade?

Thinking curriculum as a textbook is guided by the idea "knowledge to be transmitted" (Young, 1998) rather than constructed. Such a view makes teachers think narrowly and are guided by the taken for granted ideas. The role of teachers in the classroom is knowledge transmitter via whiteboard or the blackboard as well as rude language which is more guided by technical interest. They do not give much more effort to make students understand but focus on remembering the fact given in the textbook and routine problem solving without proper understanding.

During my schooling, I constructed the images of mathematics curriculum as a textbook. Whatever mentioned in the mathematics textbook was true and should be followed to maintain the distance between the bamboo stick and me. The examples given in the book were the guidelines to solve the mathematical problems. The image of mathematics curriculum that I constructed during my schooling enabled me to think that I was reading textbook and teacher was teaching textbook. How great the mathematics textbook writers were, the answers of each of mathematical problems was given, in which I was habitual to see the answer first and solve the problem. My intention was to find the answer rather than understanding and meaning-making by replicating the ideas given in the example. Understanding, sense-making, as well as relating to daily activities were secondary things which included remembering formula, theorem and repeating the same mathematical problem many times, etc. Those who were able to solve the readymade problems were known as brilliant, talented, as well as were well-known mathematicians such as Einstein, Pythagoras, etc. So we were forced to remember the fact given in the textbook and solve the readymade problems. Such types of learning experiences of mathematics prevented me from being creative and imaginative thinker as well as demotivated me to transform my learning experiences into the real scenario. There was no better environment to link the mathematics into daily activities and create the mathematical problems related to everyday mathematics. The bookish mathematical problems were created by the author or replicated from another source dominant inside the classroom.

Besides this, some queries came to my mind: Was there no other additional resource instead of a textbook? Was it necessary to solve all the mathematical problems given in the textbook? Were the problems given in the textbooks

appropriate for the particular grade level and age level of the learners? Was it impossible to create the context and mathematical problems related to the daily life? What were the authentic materials that guided the mathematics textbook to develop? These ontological and epistemological questions frequently came into my mind. By keeping those types of questions in my mind, I became busy solving the mathematical problems and remembering the definitions and theorems. Sometimes I tried to convince myself by thinking that the mathematics teachers were deprived of doing those things inside the classroom because they might be forced by the in/visible source of the society or they were reproducing the culture which was dominant in his/her life or society or practicing what they experienced. Because I was from the same society where the people still have the view that "practice makes man a perfect".

Moreover, some other queries such as: Why was there not any program to empower the mathematics teacher? If there was, who was the person to supervise the teacher or observe to find the effectiveness of implementations? Frequently, those questions struck my mind. Learning strategies or pedagogy of learning mathematics that I experienced forced me to participate in terminal examinations conducted after every three months. Those examinations evaluated my performance as well as played an important role to upgrade me. Were such types of assessment system giving justice to my learning? Was it impossible to assess continuously the students' learning outcomes? What were the reasons behind taking the summative assessments as only the evaluations tools? In my opinion, the three hours' examination is not an appropriate assessment system to assess our learning achievement. Such assessment system was more guided by the textbook oriented teaching and learning or guided by the images of mathematics curriculum as a textbook. Thus, those types of images of mathematics curriculum also motivated mathematics teacher to write the mathematics

textbook, guess paper, solution set, with the model question of the terminal as well as annual examination and recommended the students instead of reviewing and revising the mathematics curriculum, and preparing the activities on the basis of the curriculum.

I have discussed the sub-topic *you are not intelligent enough to learn mathematics* on the basis of the main topic curriculum as a textbook. Thinking curriculum as textbook enables the teachers to think differently than other traditional views about the mathematics and mathematics curriculum as discussed above. However, one of the purposes of the conception of the curriculum as a textbook is to reproduce the knowledge which is considered as universal truth and fact. Knowledge is taken as external to knowers, both teacher and students, and embodied in the syllabus and textbook (Young, 1998). So, thinking curriculum as textbooks restricts the area of mathematical knowledge of both the teacher and the students and promotes that mathematical knowledge is only in the mathematics textbook. Everyday mathematics, and cultural artifacts which help to develop the conceptual understanding of mathematics, etc. are not entertaining inside the classroom. Students are compelled to give the paper-pencil test for three hours that will check their ability to learn mathematics as well as their intelligence. Most of the school mathematics teachers in Nepal are guided by the *'hands off'* (Young, 1998) view of mathematics curriculum which might be one of the reasons to think the curriculum as a textbook. It means do not touch, do not interfere and do not revise and whatever prescribed by the curriculum development center as a mathematics curriculum is a real and universal truth.

Overall, above discussion and analysis focused on the over emphasis on the textbooks and routine problems which are existing since many years in our context.

Robitaille and Travers (1992) argue that teachers of mathematics in all countries depend profoundly on textbook in their day to day teaching, and this is perhaps more characteristic of the teaching of mathematics than of any other subject in the curriculum. This is why most of the teachers and school leaders might not have enough knowledge about curriculum and curriculum development or they have misconception of equating the mathematics textbook to the mathematics curriculum. Further, there is a lack of teacher professional development program regarding curriculum development and curriculum knowledge. There should be a curricular knowledge with teachers, so that teacher can design or redesign the teaching activities. It is necessary to broaden teachers' understanding that a curriculum encompasses far more than content written in the textbook alone through awareness program, workshop or teacher professional development program. Although textbook matters in teaching and learning process, there must be strong policy to be implemented regarding criteria of developing textbook.

Curriculum as List of Contents to be Studied: Whose Contents are These?

While I was in plus two (+2) level, I frequently checked the table of contents given in the mathematics textbook to know about left topics to learn (see figure 6 in next page). Sometimes I reminded the teacher or made them aware of the topics to be learnt. On the basis of remaining topics and remaining days to learn, mathematics teachers chose the pedagogy to teach. It means that the pedagogy used by the teacher depended on the time left for the examination.

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Figure 6

I mean if there were enough days to complete the course, then mathematics teacher, as well as students spent more time on discussion, sharing, etc. Otherwise, they only focused on problem-solving, remembering, etc., thereby my focus was on the table of contents. According to my mathematics teacher, I needed to select the topic from the table of contents which I found easy to practice. That made me easy to pass the board exam. In contrast, effective teachers find "cracks in the schedule" that allow students to pursue their passions beyond the prescribed curriculum (Tomlinson & Eidson, 2003). But during my study of plus two, the structured way of learning and problem solving continued based on the prescribed curriculum during my schooling. My learning of mathematics was based on the contents given in the 'table of contents" of the textbook. So I created another image of the mathematics curriculum as a *list of contents to be studied* during my ten plus two level in which the goal was to cover all the topics mentioned in the table of contents or to learn selected contents to pass the exam which is also known as the syllabus. The listed content along with page number is planned and prepared by the textbook author and prescribed to the mathematics teacher. Thus, teachers seem busy implementing those planned lists of content inside the classroom. So this image of mathematics curriculum is likely to serve the notion of image of curriculum as a programmed of planned activities discussed by Schubert (1986) which is focused on the peripheral notion of learning that regards learning as a

matter of planned content and activities, therefore there is no attention to the students' internal development (Luitel, 2009).

Many people still equate mathematics curriculum with the syllabus and limit their planning to consider the contents they wish to transmit or list of subject matter to be taught (Kelly, 2009). If the students' emergent knowledge and ideas are not associated to the planned content and activities, then the teacher and learning process might not effective, thereby students hesitate to share their constructive ideas and knowledge. Thus, thinking curriculum as a list of contents enables the teacher to transmit the knowledge or reproduce the subject matter in which students become the receivers. At the same time, how easy it is to develop and conceptualize the concept: the mathematics curriculum is a list of contents to be studied as shown in the figure (figure 6). In addition, the teacher used to encourage me by saying, "*The board exam questions are not different than the questions given in the textbook, question bank as well as guess paper*". So I was busy solving the mathematical problems and remembering the fact, definition, theorems, etc. Nobody told me about its applications, its relation in daily activities as well as about the mathematics curriculum.

At the same level of my study, first time I got an opportunity to learn the course "Curriculum and Evaluation". Unfortunately, there also I memorized lots of definitions of curriculum defined by different curriculum theorists such as Hilda Taba (1902-1967). Moreover, I maintained notes of important points as well as important definitions. I tried to understand the mathematics curriculum through definition. But the definitional approach of understanding mathematics curriculum enables us to sit inside the classroom with pin drop silence or memorize the definitions of curriculum. The definitional approach of understanding mathematics curriculum fails to take an

account of the educational or moral dimensions of the school mathematics curriculum (Kelly, 2009). Controlled environment in which nobody would be allowed to talk in a group, there was not the free environment to ask the questions where the mathematics classroom was guided more by the technical interest of Habermas. Besides some definitions of curriculum, some queries came to my mind such as, where can I use such definition of the curriculum? Does it help me to prepare the lesson plan and design the activities? Does it help me to solve the mathematical problem? Does it help me to develop the mathematics curriculum? Does it cover the cultural mathematics or everyday mathematics? Similarly, besides this, some images of mathematics curriculum that I discussed above, some more queries came to my mind that made me critical as well thoughtful such as: Where can I use the mathematical problem in my real life which I solved from a textbook? Who prepares that problem at first? Why were those contents appropriate for a particular grade? What were the in/visible influencing forces for the selection of content? Why did we reproduce the same mathematics for many years? Did the mathematics book writer copy the mathematical problems, examples, contents, etc. from the previous versions of the book or did they construct themselves? If they constructed themselves, why did they not give priority to everyday mathematics? Whose interest was being served?

Mathematics problems given in the textbook transported me to their own world. The mathematics world is different from my playground, market as well as my daily activities. But on reflection, why are they different? The mathematics world that I experienced during school to intermediate would seem to be systematic, structured, rigid and exact. During my schooling, I listened carefully to my mathematics teacher. The teacher explained the examples and process to solve the mathematical problem I kept practicing the new process. It was my daily mathematics routine during my

school to ten plus two level. So, I understood the mathematics curriculum in various ways that I have presented here as images of mathematics curriculum.

Understanding the curriculum in terms of textbook forced students inside the four walls of the school. Teachers were then limited to the bookish readymade problem. They themselves motivated us to be business man instead of being a great teacher. While doing so, being as authors of textbook, they could also replicate the mathematical problems from foreign mathematics books which are difficult for student to understand which promote students to take mathematics as foreign language as discussed by Luitel (2003, 2009) as the mathematical problem may not be familiar with the context of students. Language may not be understandable. Throughout the book design process, it is important to embed Nepali cultures and local issues in mathematical problem and assessment task instead of replicating the mathematical problem from foreign mathematics textbooks. However, understanding curriculum in terms of textbook also encourages teachers as well as school management towards rigid summative assessment though it is used to measure students' intelligence, ability to learn, etc.

Key Message of the Chapter

In this chapter, I as a transformative research practitioner presented my informal mathematics learning before taking my formal education. To do this, I unpacked my experience of playing mathematical rich games, communication as well as shopping different things in the market. Then next, I discussed my formal education connecting with mathematics learning in school level from primary to intermediate. These two, learning mathematics formally and learning mathematics informally should meet at a point (inside the classroom at school) but nowadays it looks like a parallel line which cannot meet together. One of the reasons to create this

situation is the textbook oriented teaching. In which, most of the textbooks contain readymade problems which are more numerical and related to foreign context. However, there are other invisible sources that in/directly create a bridge between formal mathematics and informal mathematics. Being a transformative research practitioner, I examined and critiqued disempowering structure arising from and associated with my personal and professional life world so as to develop empowering and inclusive vision for my present and future pedagogical practices, thereby committing to transform mathematics education policy, curriculum and pedagogical practices within my own institution (Taylor, Taylor, & Luitel, 2012).

Further, the narratives presented above enabled me to transform my pedagogical sensation which is relevant to our context. Moreover, depicting those narratives plays an important role to bridge the gap between formal mathematics curriculum and informal mathematics without curriculum. In my experience of learning mathematics, informal mathematics provides a strong foundation to make formal mathematics meaningful. Thus, bridging the gap between them is a necessary task in the present context. Connecting formal mathematics or formal mathematics curriculum to informal mathematics is an essential task that makes mathematics more applicable, easy to understand and interesting to school children. However, assessment system, prescribed and central mathematics curriculum, political instability, global competencies, etc. are some challenges to bridge the gap between them.

CHAPTER IV

IMAGES OF MATHEMATICS CURRICULUM: ENDORSING LEARNING AS CODING AND DECODING

In this chapter, I have critically reflected on my learning experience of mathematics education in Bachelor level. While doing so, I have continued to unpack my understanding of the mathematics curriculum as well as pedagogy and represent them metaphorically based on the research question: How did I conceptualize the pedagogical approach in mathematics from the perspectives of different curriculum images as a university student?

To do this, firstly I have reviewed my past experiences of learning mathematics. Reviewing past experiences of learning mathematic as well as curricular practices enabled me to bridge between the present and past experiences. Moreover, it helped me to envisage the future curriculum practice in/directly. Second, I have shown my excitement of entering in to university education in which I have reflected upon my expectation, real practices, etc. Third, I have discussed different constructed images of mathematics curriculum such as: *curriculum as an object of consumption, curriculum as product: being a factory worker, my own curriculum of real analysis: curriculum as cultural reproduction, curriculum as prescription.* Finally, I have concluded this chapter by reflecting upon pedagogical implications or practices which are shaped by above discussed images of mathematics curriculum. While discussing the pedagogical practices shaped by constructed images of mathematics curriculum, I highlighted learning as coding and decoding. Basically, coding refers a set of rules or

specific methods and decoding is to apply those rules and methods or procedure during mathematical problem solving.

Looking Retrospectively: Recalling Past Experience of My 'Plus Two' Study

I completed my ten plus two in education majoring mathematics from Adarsha Higher Secondary School (AHSS), Ilam, which was under the Higher Secondary Education Board (HSEB). As I discussed in the previous chapter, I have created some images of mathematics curriculum as *curriculum as a list of contents* and so more based on my experience of studying mathematics education. During my grade nine, I was not able to choose the Optional Mathematics[4] thereby faced some difficulties during the admission period for intermediate study. Some of the people who were around the administration office of AHSS told my parents as well as to me to choose other subjects except mathematics. They seemed to have believed that the basic knowledge of the mathematics of grade 11 and 12 was in the optional mathematics taught in grade 9 and 10. Thus, those who did not choose optional mathematics in grade 9 and 10 were unable to choose mathematics as a major subject in grade 11 and 12. Arriving at this stage, as a researcher, I think that they were questioning my foundation of mathematical knowledge. They believed that those who had strong foundation only could learn mathematics in higher level.

Foundationalism believes that every knowledge or beliefs must have a basic foundation upon which we can derive other forms of epistemic beliefs or what constitutes as a basis of knowledge which cannot change (Ifeyinwa, 2014). It means that the foundationalist claims that the basic knowledge must be infallible and incorrigible and those knowledge and beliefs are essential for further exploration.

[4] According to school mathematics curriculum of Nepal, optional mathematics is additional mathematics which is generally chosen by academically bright students.

Thus, the philosophy of foundationalism constrains teachers to be a creative and imaginative thinker, thereby transform same ideas and thought to the students. Furthermore, foundationalism resets upon a realist ontology and objectivist epistemology which regards valid knowledge systems being independent of political, cultural, social and spiritual influences (Aikin, 2007; Fumerton, 2005; Hopp, 2008 as cited in Luitel, 2009). Imagine, being independent of those influences what kind of knowledge are we going to construct? What kind of human beings are we producing?

I wondered to hear about the connection between those two mathematics subjects (optional mathematics and compulsory mathematics). On reflection, why did they not give the value to compulsory mathematics that I learned from the very beginning of my childhood? If taking optional mathematics in schooling is necessary for intermediate, why did the school not teach optional mathematics from the very beginning of the school level? Why have the people given the importance to optional mathematics than compulsory mathematics? Last but not the least, I wanted to raise the question: why did the policymakers divide mathematics curriculum into two sections as the curriculum of compulsory mathematics and the curriculum of optional mathematics? There has definitely been no participation of teachers and students during the curriculum development process.

Among 15 students, two of us were the ones who did not choose optional mathematics at school level. However, besides some difficulties to conceptualize and memorize the abstract concept of mathematics, I completed my plus two regularly majoring mathematics under the faculty of education. In fact, I struggled too much to understand the concepts and memorize the problems as well as theorem related to derivative, anti-derivative, limit and trigonometry. I became happy because I stepped

the stones that occurred in front of me. For me, it was more important than the SLC (now it is called SEE) examination taken at the end of grade ten.

An Exciting Moment: Entry towards University Education

However, I was excited to get enrolled in Bachelor level. Initially, I was in a dilemma whether I could choose mathematics as a major subject or not. But my relatives, friends, and teachers suggested pursuing my study with math education. Nobody asked me about optional mathematics of grade 9 and 10 like in Intermediate. Although I got enrolled as a student of Bachelor first year majoring mathematics under the faculty of education at Mahendra Ratna Multiple (MRM) campus situated in the middle of tea state of Ilam district. I started to know more about campus as it was one of the constituent campuses of Tribhuvan University (TU). I felt great because of the enrollment of campus affiliated to a well-known University of Nepal and hoped to get a better experience of learning mathematics that I ever experienced before. The initial day of my enrollment at the campus, classes were not started. I thought that the lectures were more experienced, student friendly, and would teach us through an easy way and I would not have to memorize but could learn practically. I could relate easily today to day activities. I also thought that I would have to do practical work, project work, and research work instead of readymade problem and formulae from the textbook. Moreover, my expectation was that my engagement would be with some educational philosophies, theories of teaching and learning mathematics as well as educational psychology.

Figure 7

Moreover, my big expectation was to explore the knowledge about development and implementation of mathematics curriculum, and teaching-learning methods which could be student friendly, assessment in mathematics education which could be related to formative types of assessment not related to the paper pencil test which I ever experienced during my schooling. In this context, I agree with Tomlinson (2014) as he mentioned that assessment is not something that comes at the end of a unit to find out what students learned but assessment is today's means of understanding how to modify tomorrow's assessment. Thus, assessment does not only play a role to declare failure and success of the students but can play a role to change teacher's pedagogy.

Curriculum as an Object for Consumption: Surprising and Critical Moment

It was a day of 2009; the day to attend the mathematics class at campus. The weather was cool and surrounded by the greenery of trees and the tea plant. We were 11 students introduced to each other. I was surprised to see the limited number of students in our mathematics class in which, there were more than 50 students in the classes of English, Nepali, Health, and population, etc. I was also amazed to see only two female students in mathmatics class among eleven students. There might be many reasons to become a smaller number of students in mathematics. First, because of its decontextualized nature. Second, it is a belief in our society that mathematics is male dominated subject. Third, most of the students wondered to see the lots of contents including theorem, algorithm problems, formulae, etc. and were afraid of memorizing in which, they had already come to know from the senior. Fifth, there is a belief in our society that mathematics is for only talented, brilliant and genius students so that people are afraid of taking mathematics. Except these, there might be other reasons as well such as lack of time for the students those who are job holders, lack of habit to

take risk, lack of motivation, less success rate in mathematics at universities and campuses, motivation towards technical and vocational education, etc. If same situation continues for some years, I think there will be a crisis in mathematics education which will be a big challenge for policy maker, educationalists as well as for society, teacher educator, institutions, and other education related stakeholders. In this context, I totally agree with Macintyre and Hamilton (2010) who mentioned that one of the challenges for policy makers and educationalists today is to increase the participation level of students as well as success rate within the study of mathematics. Thus, I think that this might be the subject of tension for the educationalist, institutions, school, etc. across the world.

We all were from the background of mathematics and got enrolled to learn mathematics in different ways. After a few minutes, our teacher came inside the classroom. After a short introduction, I came to know that he was going to teach us the foundation of mathematics also known as modern mathematics. I was excited to know about the curriculum of the foundation of mathematics. But he just introduced the course to study, told us the name of the book and its author and then suggested buying the same book. I came to know that the authors of mathematics book are different that of school level. Among them, we needed to buy the best one. Here, best is known as the one recommended by the teacher. It appeared that something was ready in the market to feed students.

By the same way, after an hour, another teacher came holding a book having blue cover in the left hand and board marker in the right hand. He looked as if immediately he was going to write something. However, first, he introduced and then he said that he would be teaching calculus. He introduced the course of study of calculus. Then, he also recommended the books of differential calculus and integral

calculus to buy which are available in the market and also in the campus library but to use as a reference only. Like as in previous class, I noted down the name of the books and their authors to buy them. Thus, in this context, I constructed the images of mathematics *curriculum as object for consumption* in which the object of the curriculum is already fixed and it was prepared in such a way that students have very less knowledge and experiences on particular mathematical knowledge. I came to realize that most of the teachers are guided by the predefined learning outcomes and recommend the textbook accordingly. Set of assessment task is prepared based on the predetermined goal. However, the images of mathematics curriculum as objects for consumption is likely to serve the essence of the images of curriculum as intended learning outcomes discussed by Schubert (1986) which is the process of setting learning outcomes or objectives which we wish students to achieve. Most of those learning outcomes seem as if the students have empty box and fulfill through preset goals.

However, I thought that recommended textbooks were good ones and written on the basis of the curriculum. Moreover, I thought that, like in school level, in higher level, mathematics curriculum designers might believe that students have very less experiences of higher level mathematical knowledge, thereby prepared as like a source or tools of feeding which helps students to fulfill their empty mind for certain time duration (for example, during first year of study, second year of study or third year of study). Arriving at the stage, I have some queries in my mind: Why is it necessary to learn the courses assigned by the lecturer? How do they assess our learning outcomes? Why are the students in mathematics classroom very less than as in other subjects? Why is female participation very less as compared to male participation in the mathematics classroom? Why did our teacher not prepare the

curriculum of different courses (such as calculus, foundation of mathematics, etc.) which they have been teaching for a long time?

New friends, new teachers
Different institution, new environment
New place, different infrastructure
But…
Similar pedagogy, similar black board and similar white chalk
Same number symbols and same operation symbols
Playing similar role with similar pencil paper
However …
No more differences
School and Campuses!

However, in the initial class of my Bachelor level, I have created the images of the mathematics curriculum as a *course of study*, in which the course means whatever we read in particular subject throughout the year, thereby it includes sequences of the topic, content, etc. Teaching is just telling and retelling the subject matter included in the courses. It means that the lecturer used to present the mathematical problems and the theorems by writing on the blackboard which we needed to copy to memorize. Same things were repeated again and again. There were no varieties in pedagogy as well as in contents. The textbook becomes the main resource. Assessment guided by this curriculum image is very summative in nature. Questions are already fixed from the assigned course and solutions were found in the guide and the guess paper which was available in the market.

I remember my schooling as my teacher always focused on the textbook. They thought that we were there with empty mind, black box, thereby they were there for feeding us via textbook. My experience was also the same in the very beginning of my Bachelor level classes the way I experienced at school. The institution was different, friends and teachers were new, the environment was not the same, even the

infrastructure was not the same but the way of their instruction was the same. Does this mean that I am going to be the same type of teacher? As a student of mathematics education, sometimes I asked this question to myself and tried to be critical. I have represented my initial experiences of learning mathematics in campus in poetic form as well in the right-hand side of the page. I thought that, in the beginning, teacher would show us the curriculum and learning outcomes of particular courses would tell us the way of instructions, assessment system, etc. instead of telling the content, textbook and book authors. However, it sounded good to hear if the books were related to the story and poem as well as songs that my grandfather used to tell me in my childhood actually in the winter season while sitting around the fire.

Curriculum as Product: Being a Factory Worker!

Being a student of mathematics education, I needed to complete 45 days of practice teaching in the third year of my Bachelor studies. Because one of the aims of the faculty of education is to prepare the students to be future school teachers. It covered 100 marks. I was sometimes afraid of how to teach mathematics as I did not have an experience of teaching. However, theoretically in my second year of Bachelor studies, I studied pedagogy, material developments, as well as worked on the lesson plan and unit plan based on the mathematics textbook of secondary school. Moreover, before going to the 'real' field, we also did the microteaching in which I taught one of the topics of mathematics from grade 9 to my colleagues for 15 minutes with the attendance of our lecturer, thereby I got the opportunity to improve my practice based on the comments and feedback. I realized that it was one of the ways of learning practically. However, I was unknown about the mathematics curriculum.

Finally, the day came to go to the real field. The school I chose was one of the community schools of Ilam district. We were there around 10 teacher practitioners

from the campus with different subjects. The school had around five hundred students from middle- and lower-class family. There were more than fifty staff (teaching and non-teaching). Each and every class contained more than 30 students. I remembered my schooling how I tried to bully my teachers, how to make different stories to make pretext when homework was not done. However, my focus was to get good marks because that was my practical exam. I was unknown about the schedule of my external supervisor who came and observed from campus and evaluated my lesson plan, curriculum, teaching materials, as well as classroom interaction. My internal supervisor who rarely came from the same school and provided me feedback on the very first day of practice teaching, my internal supervisor suggested searching for the mathematics curriculum of secondary and lower-secondary school level in the school's library to make a lesson plan. He further said '*there are learning objectives mentioned in every topic and accordingly you can replicate the objectives of the particular topic in your lesson plan so that you can prepare teaching-learning activities.* I felt more comfortable and visited the school's library to take the curriculum. It was the first time to see the school's mathematics curriculum. It was interesting to see the learning objectives of the curriculum. Also, I was excited because it was easy to identify the learning objectives of the lesson plan. Consequently, I came to know that lesson plan is necessary for teaching any subjects and contents because it helps to run the class smoothly. Preparing lesson plan is a process of becoming ready to facilitate the students. But those who suggested preparing lesson plan during practice teaching rarely prepared a lesson plan while teaching us at campus. Arriving at this stage, being a researcher, teacher, mathematics teacher educator, it is a big question to all the faculties those who are working at higher education of Nepal. In fact, these people have a big responsibility to improve

school education system through training, workshop, being a role model in the classroom, etc.

However, I became thoughtful and some queries emerged in my mind. If I replicate the objectives from the curriculum, then my focus will be on the achievement of the learning outcomes and then how can I use my creativity inside the classroom? Why do I not make my own curriculum while teaching? Did the curriculum that I took from the school's library articulate the experiences and prior knowledge of marginalized students? My way I mean guided by the mathematics curriculum of teaching and teaching hours, assessment system and teaching-learning activities may not be fit with that curriculum, because the context of the school is different, diverse classroom, huge number of students, etc.

The learning objectives given in the curriculum are more product oriented and guided by the *eidos.* To fulfill the objectives given in the curriculum, I must control the learning environment as well as a learner. The curriculum as the product is one of the curriculum images that I constructed during my practice teaching. Moreover, I seemed like a factory worker instead of teacher facilitator. I followed the steps and procedures mentioned in the curriculum to design activity and implemented in the classroom against students' need and interest, contextual knowledge, etc. I was deprived of teaching through the pre-specified rules by the school and curriculum. I was also in between of the crowd of mathematics teachers and educators who were guided by the post/positivist paradigm which has informed that mathematics is absolute, universal and value-free subject. The definitions of curriculum which has discussed below might have been promoting the images of mathematics curriculum as a product discussed by Grundy (1987, p. 25). A program of activities (by teachers and pupils) designed so that pupils will attain so as far as possible certain educational and

other schooling ends and objectives (Barrow, 2015). All the planned experiences provided by the school assist the pupils in attaining the designated learning outcomes to the best of their abilities (Neagley & Evan, 1967). All interrelated set of plans and experiences a student completes under the guidance of school (Marsh & Stafford, 1984).

However, the view of curriculum as product enables teachers to begin the knowledge with structure instead of thinking on how knowledge is produced by people acting collaboratively.

Although after 30 days of my practice teaching, my external supervisor came to observe and evaluated my works. I was teaching 'Profit and Loss' in grade nine. He took my lesson plan, asked for materials, and sat on the last bench of the classroom. I continued my work. I focused on the objectives given in the curriculum. Also, I created some other few objectives which were not given in the curriculum. Those objectives might cover the understanding through the concept of profit and loss contextually. He observed for 20 minutes and left the classroom. I had a few flash cards with some formula as materials, which I had shown to the students in between my class. After completing the class, I went to the staffroom. My external supervisor was waiting for me to talk about my teaching and lesson plan. At first, he commented on the objectives of the lesson plan. He disagreed with the objectives that I created my-self and he focused on the objectives given in the mathematics curriculum. He further said, "The curriculum is only the ultimate resource for teachers, and we must fulfill the learning outcomes given in the curriculum". I just nodded my head and sat quietly because I needed to pass the exam having good marks in practice teaching.

Null (2011) mentioned that those who argue that education is a business see schools as factories that produce students, teachers, and workers who mold students

into the finished product and school principals as managers whose job is to increase efficiency by eliminating waste. Teachers are looking for the outcomes or want to produce the students based on the fixed objective given in the curriculum. Thus, product-oriented mathematics curriculum promotes factory model school. Simply, factory model school tends to reduce teachers to automata and achieves social control at the cost of intelligence, intelligence broadly understood as including problem-solving, calculation as well as memorization (Pinar, 2004).

My Own Curriculum of Real Analysis: Canvas of Curriculum as Cultural Reproduction

It was any day of 2012; I was sitting in the class of Real Analysis. It was one of the mathematics courses that I studied in the second year of Bachelor's degree. The lecturer entered the class with some pieces of paper on his right hand and stick of chalk in his left hand. I came to know that he was going to teach us Set Theory. Initially, I felt happy because I studied set in my schooling and I thought it would be easy. It was wonderful to see how he easily supposed two capital letters as a set. On the basis of those 2 sets which he supposed, he was trying

Mathematical problems were transformed to the meaningless theorem
Algorithm and calculation were transformed to the worthless definitions
Day by day, mathematical symbols are becoming stronger
Textbook and curriculum were replaced by the guide and guess paper
Small portion of memorization transformed in to large one
Although…
Assessment system is still same
Way of instruction remained same
Lack of awareness, no heed to responsibility
No transform action in pedagogy!

to make us understand the difference of set, union of the set, the intersection of set and complement of a set.

I realized that the definition of union and intersection of set and definitions of differences and complement of the set were difficult in Bachelor level. It included different mathematical symbols and technical words. At the same time, I had some queries why he did not connect the set-in real-life example as I saw the set of different objects around us inside the classroom. However, I kept questioning myself. I realized that I was wrong. I had to memorize everything. After that, the teacher started to copy the theorem of the set on the blackboard from the paper he brought. He also used to say that, the theorem, as well as the definition of set theory, is very important for the exam, so I became alert and copied properly. The teaching looked like conforming some ideas and knowledge which was already developed and learning happened when I memorized the conforming ideas. Thus, rote memorization as one of the cultures that students were doing and conforming the ideas and mathematical facts were another culture which was done by the teachers. I did not know what the real application of that theorem was and how it was developed. I expressed my difficulties to catch that definition and theorem to the lecturer. He responded that he also learnt those things in the same way. His teacher also guessed the important questions and theorem and asked him to memorize. Whatever he prepared a note of the course real analysis during his Bachelor and Master's level, the same things he transformed us and asked us to memorize to pass the exam. Then, I came to know about the paper that he always kept in his hand while teaching.

However, he used to say "It is my own curriculum of Real Analysis that I developed; I always teach on the basis of this". Further, he explained, "I have collected some important theorem and definitions, so you must follow me and

memorize each accordingly so that you can pass this course easily". The word 'my own curriculum' really made me thoughtful. How did he prepare his curriculum? Did he incorporate students' experiences? Was that inclusive and contextualized? The only one answer of those questions is 'no'. He did not. He used to say my curriculum, but he prepared by collecting the so-called important theorems and mathematical problems from the textbook and delivered to us. It means that he was producing his ideas and reproducing the others' ideas and contents. He was busy writing the definition of the open and closed set, union and intersection of the set as well as differences and complement of sets. In between, he said that "many students dropped major mathematics and chose another subject because of this course".

1. ***The union of open sets is open.***
2. ***The intersection of closed set is open.***
3. ***A set is closed if and only if it contains all its limit points.***

…

(Trench, 2013)

Accordingly, he started to write theorems related to the set theory as shown in the box above. I realized that it was easy to remember the solution of readymade problems, calculation, multiplication table, procedure, etc. than the worthless definition and meaningless theorem. Those theorems which were neither related to the story nor related to daily activities of my life. But it was a must to follow the work of the previous generation and memorize to pass the exam. On that day, I sat with one of my friends who was a very genius and his aim was to become the professor of mathematics at university. Then, he shared that he also started to make a note of Real Analysis so that he could use the same material during his teaching as our lecturer did. In my opinion, this type of teaching in the university promotes teachers to reproduce the culture they experienced. In-terms of creativity and imagination, culturally

reproduced knowledge (especially based on theorem, definition and algorithm problem) was really harmful to the students.

Schubert (1986) highlighted the notion of the curriculum as cultural reproduction and mentioned that the job of schooling is to reproduce salient knowledge and values for the succeeding generation. It means that the educators' knowledge, ideas or whatever they knew and learned were transformed into a curriculum that could be transformed to the students. The same kind of knowledge, teaching pedagogies and teaching material are repeated time and again to deliver the content inside the classroom, no matter how the students are, their experiences, etc. How the teacher learned in his/her schooling is of more importance rather than why and what to teach. This might mislead teachers and choose the same type of student assessment tools where they were evaluated during their schooling. The teachers looked busy replicating the same ideas which were presented in the previous year.

Lecture method which is highlyteacher-centered also called 'banking pedagogy' (Freire, 1993) is dominant in such a classroom. This aim of the curriculum seemed to be interested in controlling the environment, students as well as teachers or lecturers. This disempowering image of mathematics curriculum inhibits students' creativity as well as prevents them from becoming an imaginative thinker. However, the images of mathematics curriculum as cultural reproduction empower and encourage people to reproduce the mathematically rich games and tradition as I discussed in the previous chapter. Marina (2017) mentioned, "If one intention of mathematics education is to reproduce the culture, then mathematics problems would be enriched by cultural contexts" (p. 47). I also agreed on this statement because in our context, it is difficult to change the belief systems that have already shaped the society. It seems good to value the common practices which are mathematically rich

but need to see those practices from different lenses based upon time and context. We need to value, legitimate and reproduce certain cultural practices which are part of the students' day to day activities which are the positive parts of this curriculum image (Luitel, 2009) and reproduce unhelpful hegemonies, hierarchies and false consciousness that are the negative aspects of this curriculum image (Apple, 2004 as cited in Luitel, 2009).

One of the important roles of transformative and progressive educators is to change such beliefs and concepts which promote the images of mathematics curriculum as cultural reproduction. D' Ambrosio (1985) also argues that the form of ethnomathematics, as well as culture, might also be changing following cultural movements in society. In this 21st century to change the culture according to the cultural movements is the main challenge for the educators. More specifically, such dominant cultures are assessment systems which are more summative in nature, political activities in school education and higher education, teacher-centered pedagogy, less parental participation, etc.

Curriculum as Prescription: Who Prescribes to Whom?

Taking my educative process of Bachelor's level as a reference, I try to understand the meaning of curriculum in general and mathematics curriculum in particular during my second year of bachelor's level as I studied curriculum and evaluation as a compulsory course. I learned similar course during my +2 but did not get enough understanding and meaning of mathematics curriculum. Although the way of engaging in my second year of Bachelor with the course 'Curriculum and Evaluation' was not

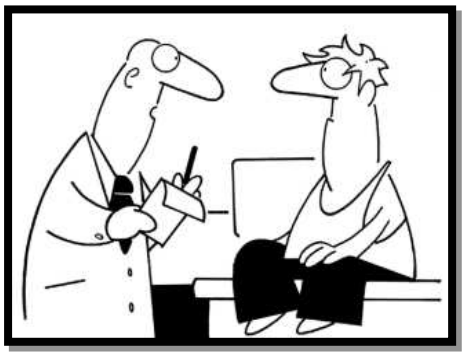

Figure 8

different than the way of engaging on the similar course in my +2 level. The study was just limited to the textbook of the curriculum. I was forced to learn the course, namely curriculum and evaluation to pass the exam instead of knowing its development process, its role in the classroom, etc. Thereby, I seemed busy memorizing the definition of the curriculum which was mentioned in Ellis (2013, p. 2)

A prescribed body of knowledge and methods by which it might be communicated.

Allan Block (1998)

A program or plan for all experiences that the learner encounters under the direction of the school. *Peter Oliva (1997)*

The master plan devised by educators and other adults in a community, state, or nation that will best serve their needs, and, as they see it, the needs of their children.

Donald Cay (1966)

A plan for learning. *Hilda Taba (1962)*

Many definitions and description of curriculum have been offered by philosopher and educationalists since long back till now in different ways. Those definitions of curriculum tend to be prescriptive, descriptive or combination of both. In this context, my experience reveals that the definitional approach of mathematics curriculum is one of the traditionalist ways of understanding the mathematics curriculum and it promotes prescriptive nature of mathematics curriculum. In addition, definitional approach of knowing curriculum dominant in school practices, which in/directly affects education in general and mathematics education in particular. Prescriptive nature of definitions provides us with what ought to happen, and they more often do not take the form of a plan, an intended program, or some kind of expert opinion about the needs to take place in the course of study (Ellis, 2004).

Moreover, the definition of the curriculum as shown as above, which I frequently memorized during my study of Bachelor as well as +2 level. Those definitions seemed like as a plan, a map and a prescription to be followed. Such kinds of definition did not enable me to know about the role of teachers, students and school during the teaching and learning process. The teacher/learners are bound by the words used in the definition due to which the concept of the curriculum is narrowed down leading them not to think broadly about the curriculum. I do not mention that all the definitions of curriculum restrict the learners to broad thought but in our context such kinds of definitions are given priority in teaching and learning process. In addition, definitional approach of knowing curriculum in general and mathematics curriculum in particular might enable learners to narrow down their understanding. It might develop the concepts like something is fixed as well as rigid. In our context, there is a negative belief that definition of curriculum is more important than curriculum which is why there exist the summative assessment system from school level to university level. There is a culture of asking questions like: what is curriculum? Explain with definition or How did Hari define curriculum? Explain, etc.

From the examination point of view, those definitions of curriculum, as well as elements of curriculum namely, objectives, content, teaching/learning process, and evaluation, are very important. These are the things to help obtain good marks in the exam. Our teacher often encourages me to memorize some definitions of curriculum and elements of the curriculum. Regarding the elements of the curriculum, if we have to write short answer, then there is no need to explain about that but if we have to write the long answer, then it is necessary to explain about each element of the curriculum. It was believed that instead of leaving the question at least half marks of

the full marks of the question could be scored if we only memorized it. Almost all of us memorized the elements of the curriculum with/out understanding the meanings.

These activities (especially activities done for the exam such as rote memorization) become an instrument which control the environment and reduce the multiple possibilities of learning. I came to know that such an approach of learning was an intention to control the classroom's (either schools' or campuses') activity via set of manageable and instrumental actions. Instrumentalism promotes teachers to look school subject and humans as instruments, as tools or means for reaching another goal or end (Varkoy, 2007). Consequently, the society can be an important instrument for giving the impression that mathematics in an unchangeable body of knowledge, in which the mathematical routine problems are solved through fixed instrumental procedures. Moreover, Mellin-Olsen (1981) mentioned that instrumentalism produces instrumental understanding, which is opposed to relational understanding. Indeed, instrumental understanding or instrumentalism encourages students and teachers to follow the rules which are already established, manipulated as well as used, whereas relational understanding encourages students and teachers to investigate towards rules, why and how they work instead of knowing and applying the rules or facts.

However, I did not know about the curriculum elements as well as I did not analyze its definition in depth. As I mentioned above, I memorized the curriculum elements (objectives, contents, etc.) from the examination point of view. I moved ahead and prepared for the exam as I was instructed by the lecturer. During my six months of study, I remembered some definitions of curriculum and I came to know that curriculum is an essential material for the teacher. Especially, it is useful for the teacher during the planning such as annual plan, unit plan, and lesson plan. Similarly, rest of six months, I have collected guess papers, question paper with answers of

previous years of the course Curriculum and Evaluation to prepare for the exam. On reflection, did my school mathematics teacher and university teacher really use the mathematics curriculum? Did they workout on planning? Were they involved in the curriculum design process? What is my role if I become a teacher?

I came to know that, in the context of Nepal, school mathematics curriculum is prepared by the CDC, Nepal. After preparation, it is distributed to the teachers as a prescribed document. Later on, I was surprised to know how the people in CDC were selected to make the mathematics curriculum. How is their expertise to develop the mathematics curriculum evaluated? How do they know the context, environment, locality, experiences of students and teachers, of different places across Nepal? Also, I came to know that the same curriculum is prescribed to all the schools and institutions. After knowing this, many queries came to my mind. Actually, who is there in CDC? How do they prepare the school mathematics curriculum? Why don't teachers involve in the curriculum development process? Does it fit in every school located in different places across Nepal? What may be the in/visible forces to make curriculum prescriptive in nature? Curriculum is the heart of education and those who make curriculum need to pay attention to what is happening in other fields that integrate theory and practice (Null, 2011). Students might be more creative as

> What is curriculum? What is it for? Who is it for?
> Who should make curriculum decision?
> How should these decisions be made?
> How should curriculum makers structure the decision-making process? What should they do to make good curriculum and what should people who specialize in curriculum development do in order to make curriculum better? What characteristics, or virtues, should these people possess?
>
> Null (2011, p. 5)

well and learning becomes more contextual and curriculum becomes inclusive if curriculum is prepared on the basis of cultural practices and students' experiences incorporating the current issues and practices. Curriculum also directs or it opens the floor to explore new ideas and knowledge. Thus, the role of the curriculum is not limited to the knowledge but to give the platform to explore knowledge. Thus, the education and the curriculum may be different things. In this context, Null (2011) mentioned that curriculum requires those who discuss it to address what subject matter should be taught but education is frequently discussed without regard to subject matter, but every discussion of the curriculum must address subject matter in one way or another. Identifying these differences between curriculum and education helps teachers to become effective teachers and thoughtful curriculum makers. Dealing with the questions as shown in the box above during the curriculum development process is essential to make a learner-centered curriculum.

If the tradition of prescription of the curriculum does not end,then it is difficult to make the students locally and globally competitive. Because prescriptive nature of curriculum does not cover the students' experiences or it may not be able to identify students' previous knowledge as well as teachers' capability. So, teachers are compelled to force students to learn mathematics out of interest of the students. In this context, Roman educator Quintilian also argued that forcing students to learn things is just a waste of everyone's time and such learning goes in one ear and out the other (Ellis, 2013). This sentence of Ellis really made me thoughtful and remembered my school days as my teacher sometimes scolded me by saying '*eak kann le sunara aarko kan le uduana*[5]*'.* Thus, one of the characteristics of a prescriptive curriculum is to make such type of teachers force students to learn as they prescribe. It is also some

[5]Old Nepali myths; in English listening goes in one ear and out the other

kind of expert opinion about what needs to take place in the course of study (Ellis, 2013). Thus, there are no more differences between prescriptive nature of mathematics curriculum and the speech given by the political leaders to non-political people.

Reflecting on Pedagogical Practices: Learning as Coding and Decoding

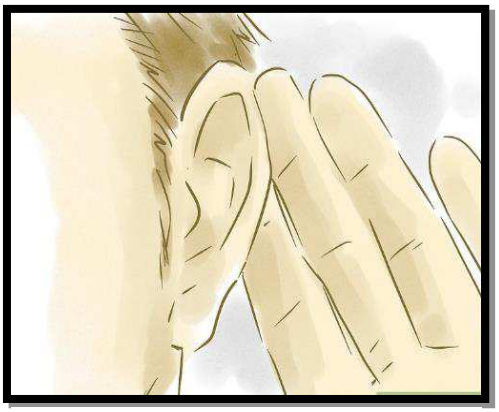

Figure 9

It was a sunny morning of March 2015. I was sitting in my own room. I had my laptop infront of me, chapter two of the book called 'Pedagogy of the Oppressed' was displayed on the screen. Warm sunlight entering from the window helped me to add energy in cold weather to read the displaying chapter on the laptop. Suddenly, my eye went into the third paragraph of the chapter. The author had highlighted the characteristics of narrative education in which teacher as narrator and students as receiver, recorder as well as memorizer. More specifically, Freire (1993) mentioned that:

> The outstanding characteristic of the narrative education, then, is the sonority of words, not their transforming power. "Four times four is sixteen; the capital of para is Balem." The student records, memorizes, and repeats these phrases without perceiving what four times four really mean, or realizing the significance of "capital" in the affirmation "the capital of Para is Balem," that is, what Balem means for Para and what Para means for Brazil. (p. 71)

Extremely, the above statement made me thoughtful. It also summarizes the implications of the above mathematics curriculum images that I constructed after completing my schooling but during my Intermediate and Bachelor (B. Ed.) levels.

Like as four times four is sixteen, the capital of para is Balem there were uncountable numbers of theorems and algorithm narrated by the teachers from the textbook instead of constructing those types of theorems as well as discussion on the application. For instance, $\frac{d}{dx}(sinx) = cosx, \int dx = x + C, \int cos\, x dx = sinx + C$, etc. are some facts or let's say formula. During my Bachelor and Intermediate level, I never understood how those situations formula or facts were constructed. The meaning of $\frac{dy}{dx}$ and deadly symbols like $\int$ were always heated in my mind. These were some examples only, there were lots of symbols and facts that I recoded from the narration of the teacher and memorized later to pass the exam. Most interesting thing is that we students wondered how the capital letter 'C' with the sign of addition $(+)$ came in $\int cos\, x dx = sinx + C, \int sinx\, dx = -cosx + C, etc.$There was no more discussion behind the theorems and algorithm or formula. Our job was to just listen and record whatever narrated by the teacher in to our note book. Whenever it was necessary, I mean while I had to attend the examination, I had to revise and repeat, in which the ultimate goal of doing all was memorization. Reading some critical papers, book related to mathematics curriculum and mathematics education forced me to think that if teachers themselves got an opportunity to involve in curriculum making process, then students like us may not be suffering from the narration sickness of the education system.

However, until and unless the structure and the education system from school level to university level are changed, then students always get victimized from the narration sickness of education which is not possible to treat from the doctors. Commonly speaking in our society, thousands of students can die because of one error or being misguided by the teacher, but one patient can die because of one error of the doctor. It does not mean that small error done by a doctor is fine. It looks like a simple

and normal sentence but if we go into the depth of the sentence it can take an important place in our education system. It shows how big impact (positive or negative) can occur from teacher to students. The book author, researcher, and other educators have started said that the learning and teaching approaches of mathematics have been changing, drill and memorization are now changing into creativity and problem-solving. For instance, Oers (2003) mentioned that over the past fifty years the classroom approach to mathematics has changed radically from a drill-and-practice affair to a more insight-based problem-oriented approach. On reflection, does it match in our context? Is it applicable in the school where I have completed my primary, lower-secondary and secondary schooling? Do school students start to experience more differently than me?

In the context of Nepal, school teachers might not be free in terms of making educational policy, curriculum development process, etc. But they are imposed readymade materials to implement by the higher authority. If there is a teacher as well as representative students' participation in the process of selecting content, or curriculum development process, then the role of teacher might not be limited to the narration process only. Involving teacher and students during the curriculum making process creates a dialogic environment that helps each other to negotiate, communicate, raise the question, and helps them to come with a better solution. More specifically, it helps teachers and students to be more responsible and accountable.

Learning as recoding and memorization, especially focuses on mastery of arithmetical operation. Learners are supposed to be a factory machine or robot which needs to function on the basis of narration of the instructor. Moreover, mathematical knowledge is supposed to be constituted of fixed objects. It is also believed that the elements of mathematical knowledge can be transmitted to children (Oers, 2002)

which portrays that mathematical knowledge is fixed, not changeable, and can be transmitted into the coming generation. Somehow, it can be transmitted as well, but better to transmit after revising and editing. There should be a place for students to invent new mathematical knowledge on the basis of their own experiences. Thus, in our context, those who are in the place to make mathematics curriculum might have been guided by pure mathematical knowledge. The policy makers, curriculum developers or other people who are working in the field of mathematics education have been playing an important role to shape the teachers' beliefs (positive or negative) towards mathematics (Luitel, 2019). Such beliefs can in/directly impact on teaching and learning process. For instance, if teacher's belief is towards pure mathematics, then teaching is more textbook oriented, focuses on the algorithm, as well as promotes records and memorization approach of learning.

Key Message of the Chapter

In this chapter, I presented how I understood the mathematics curriculum during my educational journey and represented it metaphorically, especially of the time between 2007 A D to early of 2015 A D. At that time, I was following the thoughts and ideas of my senior and junior friends, brothers and sisters, teachers and relatives or who cared for me and I tried to obey them and made decision myself to secure my future. While doing so, I sometimes moved towards private collages, university campus, educational institutions, where I got the formal education. Thus, the images of mathematics curriculum have been discussed here in this chapter on the basis of my learning experiences in Bachelor level study.

I began to encounter mathematics curriculum through my better experiences of learning mathematics at school and Intermediate level. That has worked as a bridge to connect my schooling to Intermediate and university education. Everybody has an

excitement in their achievement but ways of expression maybe different. Thereby, initially, I expressed my excitement with lots of expectations of enrollment towards university education. I myself considered a great person. With the enrolment at university campus, I got an opportunity to interact with teachers or lecturers, junior friends and senior friends, relatives, and myself as well as larger socio-cultural context that enabled me to create those images of mathematics curriculum in various ways. After remembering and filtering those interaction and communication, I have discussed mathematics curriculum in different four ways. Each of them has its own objectives and pedagogical perspectives. Each image of mathematics curriculum in/directly affects educative life. The chapter also concluded that isolating teachers and students from curriculum development process has produced the narrator and recorder instead of good teacher/facilitator and students/learners. So the essence of each image of mathematics curriculum that has been discussed in this chapter encourages students to become recorder and memorizer.

In next chapter, I continue to discuss different images of mathematics curriculum on the basis of my lived experiences of teaching mathematics. Moreover, in this chapter, as I started to discuss the narrative sickness of education. I discussed in detail the narration role of teacher and recorder and memorizer role of students under the different images of mathematics curriculum.

CHAPTER V

IMAGES OF MATHEMATICS CURRICULUM: ENDORSING TEACHING AS ONE-WAY TRAFFIC

This chapter portrays my experience of teaching mathematics at different schools. As I started to work as a teacher since 2014 from one of the institutional schools to date, I have critically analyzed and evaluated my experience of teaching mathematics, especially focusing on the mathematics curriculum, assessment and pedagogy. This chapter might show the pathway to incorporate effective pedagogy or practices to enhance better students' learning outcomes. Especially, this chapter reflected by journey of higher education in which I have unpacked my experiences that I experienced after completing my Bachelor's degree. Similarly, what and how I experienced regarding teaching mathematics is reflected in terms of curriculum and pedagogy as well as assessment.

To do so, first I have reflected the experiences of people in the society regarding higher education. Second, as I started to teach mathematics, I have unpacked and critically analyzed the mathematics curriculum under the images of curriculum as cultural reproduction. Third, as I have worked in different institutional schools, I have reflected my understanding of mathematics curriculum under the images of *curriculum as foreign language: narrating/teaching for promoting foreign mathematics.* Similarly, I have discussed the mathematics curriculum under the image of *curriculum as a sequence of algorithmic problems: teaching as narration of the problems and solution.* Then I have discussed and analyzed the present mathematics curriculum from the perspective of parents under the images of *curriculum as*

textbook. At last, I have analyzed critically about pedagogical practices based on the topic *teaching as one-way street* which might be promoted by the previously discussed images of mathematics curriculum based on the research question: How did I construct different disempowering images of mathematics curriculum and promote one-way narration?

Views on Higher Education: Reflection of Community

As I completed my Bachelor's level at the end of 2012 A.D, I was in a dilemma either start to work as a mathematics teacher at institutional school or prepare for government job or continue my higher study in mathematics education. At that time, one of the institutional schools in my village offered me to teach mathematics but I ignored because I wanted to pursue my higher education from the renowned University of Nepal. Some of my relatives and neighbors said that Bachelor level of education was enough for our life as it does not matter to get higher education (such as Master's degree) in human life and our day to day life. Further, they (neighbors in my village) requested me to observe in the villages as well as in some urban areas that many youths are unemployed who earned their higher degree such as Master's and PhD. They also found time to give their own examples that they did not have any formal education but were surviving properly and running their business well. People having those beliefs and thoughts really made me thoughtful as well as lots of questions came to my mind. Why do people discourage me from earning higher degree? What's wrong with our higher education system? Are there any faults in our education system? However, I got time to understand the beliefs and thoughts of people about the Nepali higher education system. However, having listened to those words from the neighbors, I also reflected the moment of

memorizing mathematics formulae, steps of problem solving, etc. and saluted those people who critiqued the Nepali education (higher) system.

On other hand, some of my relatives and friends encouraged me to continue my study by giving the examples of the people who earned the certificate of higher degree (Master's and PhD). Now I realized that those situations were one of the critical situations of my life because I was in a dilemma whether to continue my study or not. However, after taking consent from my mother, I decided to continue my study. So in the month of February 2014, I went to Kathmandu (capital city of Nepal) with my uncle for Master's degree with lots of hopes and expectations. Initially, I was again in a dilemma to choose the University for my Master's degree. In that situation, I was suggested by one of my uncles as he has been working at Kathmandu University School of Education, and it was said that Kathmandu University School of education has been providing the quality education for students. Honestly speaking, before that I was not much more aware about the University. So initially, I looked towards TU as most of my friends were there. Finally, I decided to do Master in mathematics education from Kathmandu University School of Education (KUSOED). Later, I came to know that it was almost six months left to announce admission call for Master's degree at KUSOED. As I was suggested that I had to pass the entrance exam so that I could be eligible for the enrollment. So that started preparation for the entrance exam. Moreover, I was also suggested that it would be easy to face the entrance exam as well as whole master's course if I had an experience of teaching, thereby I started to work at one of the institutional schools at Bhaktapur district as a mathematics teacher.

A Brief Journey of Becoming a Mathematics Teacher

Figure 10

I started to teach mathematics at one of the institutional schools in Bhaktapur district over the last two last months of the year 2016 AD. Because of not having experience of teaching, the principal of the school requested me to work voluntarily for two months. Accordingly, I did. It was almost the time for closing the academic session and preparation for the new academic session was going on. Teachers were preparing for the final examination so that they were preparing the question paper, and had already started to revise the lesson. Thereby, I just helped them in their work for making question and doing revision. Sometimes I went to different grades (grade 3, grade 5, grade 8, etc.) and helped them to solve the routine mathematical problems. At the beginning of the new academic session, I was formally appointed as a mathematics teacher for primary and lower secondary level. I had to teach from grade 3 to grade 7. I read in a book that "teachers are examiners of all curriculum, teaching, and evaluation programs and researchers of their own works" (Hua, 2015 p. 53) so I felt myself motivated and responsible.

My main focus was to get an experience of teaching by helping the students to learn mathematics and learn about teaching and learning approaches as well as make educative relation between school educators, parents, school and socialize with the groups of people. Therefore, my core focus was to interact with the educators, students as well as get experiences rather than grow economically. So I was happy to be a teacher of that school.

Becoming a Universalist Mathematics Teacher: Promoting Universalism

It could be any day of April, 2014; I became ready to go to school as a mathematics teacher. It was my first day of new academic session so I thought I did not need to teach that day. But immediately some questions emerged in my mind: If I need to teach then which topic do I need to teach? What strategy of teaching enables me to start the class? In which grade do I need to teach first?, etc. So mentally I was prepared to teach algebra of grade 7 to face the challenges and got ready to go to school. I took bus from the bus station and reached the school after fifteen minutes. Honestly speaking, from the very first day, my intention was to engage with students discussing any topic of mathematics rather than teaching according to the syllabus. During my bus time, I tried to remember my schooling, my learning styles and my school teachers' teaching styles. Those remembrances made some changes in my previous mental plan. So I planned to discuss the formula $(a+b)^2 = a^2 + 2ab + b^2, (a-b)^2 = a^2 - 2ab + b^2$ and its uses during the problem solving. I thought it would be easy to interact with the students because; first I spent too much time to memorize this formula and solved many routine problems using those formula during my schooling rather discussed derivation of formula. Second, I was oriented that it was one of the things which was same all over the world. So I developed the notion of *mathematics curriculum as the document of universal truth knowledge.* Thus, arriving here as a teacher researcher, I want to raise the questions: Is pedagogy same for teaching those kinds of formulae all over the world? Is the procedure of solving problem similar?

Apart from this, I remembered the use of different letters such as $x, y, z, a, b, etc.$ during the class of Algebra. Most of the times in Algebra, I used those literals instead of numbers but it was difficult to understand what exactly those letters

meant. Teachers frequently said that they were some mathematical symbols and were used to represent different numbers as well as used to define constant and variables. Moreover, I wondered to see same letters ($such\ as\ x, y$) sometime became constant and sometime variables. For instance,

$x\ represents\ the\ height\ of\ Mount\ Everest. Again, x$ *represents the number of students in a school.* No more explanations and conceptual discussion on how it was possible. Was it necessary to use those letters instead of numbers? Did assuming those letters instead of number make learning contextual? These are some questions which have been making myself aware while teaching mathematics in the classroom.

Most teachers of Nepal think that algebra is simply about manipulations of symbols representing constant and variables by using laws, principle and formulae (Shrestha, 2019). Thus, today's one of the challenges of our education system is to overcome such types of beliefs of Nepali mathematics teachers, students as well as other stakeholders. Moreover, I was initially surprised to see those symbols, so called literals were connected by the different mathematical operations ($+, -, \times\ and\ \div$)such as $x + y, xyz, x - y, etc.$ I ever saw the operations of literals before but I was familiar with operation of numbers. So I developed the notion of *mathematics curriculum as collections and operations of letters, curriculum as tool of solving for* $x\ and\ y$. Collection of letters in mathematics in general and algebra in particular enabled me to perform addition, subtraction, multiplication, and division using those literals. Moreover, tagging school friends or teasing using those literals was another interesting part during my schooling. Now I realize that most of the mathematics teachers have very limited ideas about "conceptual algebra readiness that lays a foundation for children to make sense of algebra rather than to manipulate symbols mindlessly" (Feikes, Schwingendorf, & Gregg, 2014) and less aware that "algebra is

basically about establishing relation among numbers, thereby giving rise to generalization with the help of symbolic representation" (Shrestha, 2019 p. 146). Indeed, algebra is about generalization and help students in logical reasoning as well as relational thinking. For instance, learning the relation of $(a+b)^2 = a^2 + 2ab + b^2, (a-b)^2 = a^2 - 2ab+, etc$ through the model as well diagram helps students to develop their algebraic thinking and reasoning using the concept of geometry.

On the other hand, Nepali schools and Nepali school teacher are normally guided by the philosophy of universalism (Luitel, 2009). There is a belief that students need to be competent locally as well as globally. However, giving priority by school as well as teacher for global competence followed by universalism really impacts on learning mathematics, thereby symbolic expressions are dominant in teaching and learning mathematics. The notion of universalism is portrayed as a simplistic portrayal of human subjectivity which presumes we all are the same in some banal sense (we all eat, drink, need clothes), or else, we should all be striving to be the same in which our ideas, customs and beliefs will eventually one day become the same; that is Western (Mirza, 2012). Thus, Universalist views of mathematics encourage teachers, teacher educators, students, etc. to incorporate symbols, and formula, thereby objectivity of mathematical knowledge is dominant and leads towards to be as Western. Moreover, mathematics is considered as body of certain knowledge, independent and pure thought, a system of abstract symbolic expressions (Luitel & Taylor, 2007), curriculum as subject matter, curriculum as collection of symbols, etc. are some powerful images endorsed by universalist views of mathematics.

Finally, by remembering and reflecting my schooling, I reached school, introduced with new teachers and some of other teaching and non-teaching staff. The

school led by the team new teachers, even the principal was new. Thus, we introduced each other. I saw the students entering inside the school premises from the main gate. Some groups of the students were playing on the ground and some of the students looked like feeling alone and nervous because of being newly admitted. One school staff took me to other two teaching staff to visit the different classes, school premises such as playground, canteen, etc. I was shocked to see the small playground being paved with the bricks of cement. I raised question myself: how to play the game which might be mathematically rich but not in such kind of small play ground by a huge number of students? Is it possible to play the different games in the paved ground? Is that safe for students? However, the classroom infrastructure and sitting arrangement was good which I ever experienced in my schooling. Happy to see the library with lots of books where students could choose the book which they wanted to read which I had ever seen in my schooling. Moreover, on the very first day of school as a teacher, I introduced with some students in/formally, knew their interest towards mathematics, way of their learning mathematics, and talked about the content based on Universalist view of mathematics as I planned.

Visiting School Library: Searching for the Mathematics Curriculum

It was a day in August 2014, I was seeking to know about the mathematics curriculum of primary and lower secondary level because I learned about the curriculum during my study of Intermediate and Bachelor level and came to know that it is an important resource for teaching and learning mathematics. Further, quality curriculum should play a central role in meeting the core needs of students' affirmation, affiliation, accomplishment, and autonomy (Tomlinson & Mc Tighe, 2006). Here, the quality curriculum refers to the non-official mathematics curriculum which is flexible and open to revision based on the changing context. Thus, I made a

plan to use prescribed mathematics curriculum as a resource during my teaching by making it contextual, incorporating students as well as myself experiences. But in contrast, school principal suggested some of us (new teachers) taking some course book which became useful to me. I asked the question myself: why did he prefer textbook instead of mathematics curriculum? As per the advice of the principal, I took some of the mathematics books of primary and lower secondary level from the library. I asked the librarian about the mathematics curriculum as well as searched in the library but I did not get it. The librarian was not aware about it. She replied that *all the teachers are using the textbook to teach since the establishment of the school*. Further, the librarian added; "*everybody of us completed our schooling by reading textbook and taking exam. In the case of mathematics, we have experienced that we completed schooling by practicing the mathematical problem through textbook even you may as well. So, it is better to follow same and we believed that whatever we learnt is prepared based on the mathematics curriculum. So, why do you need curriculum?"*

I returned back to the staffroom and talked with other teachers who were close to me. They also said the same things that they did not know more about the curriculum. They just reproduced what they learnt during their schooling and transmitted the knowledge through textbook. So I developed the notion of *mathematics curriculum as the reproduction and transmission of limited knowledge.* Arriving at this stage, I agree with Hua (2015) if knowledge transmission is the essence of teaching and schooling, there will never exist true inquiry, problem-solving, and knowledge creation. Students' knowledge and capacity is also assessed through bookish readymade routine problem. Moreover, Hua (2015) mentioned that the role of teachers is not to only transmit textbook knowledge to students, just as a

postman delivers mail but also teachers' transmitting process itself should be strictly and efficiently controlled.

Reproducing and transmitting the content from the textbook kills the students' creativity and reduces their imagination skills. The teaching and learning methods promote the ideas and values that have been practiced for many years before based on the ideology of technical interest. The main aim of technical interest is to control the student knowledge based on monological laws and uniform rules in which educational process is degraded as the teacher controls and disciplines students' mind by knowledge and skills training (Hua, 2015). Teachers play the main role inside the classroom because students may not be aware of the previous culture and practices. So teaching is based on the planned content which is already organized and prepared, thereby the emergent issues, constructivist ideas of students, etc. take less values in the classroom. Moreover, this image comes from the view: curriculum as reflection of the culture. Thus, it maintains the status quo so that it does not help to develop the critical thinking, imagination as well as creativity of the students. This image of mathematics curriculum always promotes teacher to look back to find what has happened in the past, what were the practices, what mathematical contents are dominant rather than looking for new approaches of teaching and learning. This image of mathematics curriculum is promoted by the deductive model of the curriculum development proceeds from the general to the specific. The recent practice of curriculum development process in Nepal is deductive approach.

Further, the notion of curriculum as reproduction and transmission of knowledge enabled me to act myself as a more knowledgeable person, thereby I thought that teacher should fill their (students') empty mind from the textbook. Initially, in my teaching, everything I narrated to the students from the prescribed

textbook. My intention was to complete each and every exercise of the textbook. There was very less opportunity to discuss conceptual knowledge as well as indigenous mathematical knowledge (see chapter VII). However, until and unless there is participation of teachers and students in curriculum design process then teacher might act as a person to fill the mathematical knowledge to the students by solving mathematical problems given in the textbook through narration and telling summary. So the education becomes an act of depositing, in which the students are the depositories and the teacher is the depositor (Freire, 1993). More specifically, narrative process of teaching or culturally reproduced curriculum enables teacher to teach mathematics instead of teaching children. It makes students listener, makes teachers think that they know everything and students know nothing and so on.

Curriculum as Foreign Language: Narrating/Teaching for Promoting Foreign Mathematics

It could be any day in April 2016. I felt proud of being selected in a reputed institutional school inside the Kathmandu valley. It was a good opportunity for me to learn about the progressive education practically and to work on recently growing school with good infrastructure, good management team, as well as qualified and skillful teaching staff who were working with the next generations to shape their bright future. I came to know that the school follows the national curriculum for each subject including additional activities such as swimming, long and short educational trip as well as different mathematically rich activities, projects, etc. On reflection, does prescribed national curriculum serve the students' needs and specific interest? Does it fit with the school context and students' experiences? Does it cover the indigenous mathematical knowledge? Does it help teacher to run the classroom on the basis of the philosophy of the school?

However, later I came to know that teacher and to some extent students have autonomy to incorporate local knowledge, experiences, of teacher and students, etc. while teaching and learning process by revising the curriculum. Teachers were free to develop mathematical activities and worksheets including contextual real-life problem which is different than bookish routine problems. Those activities as well as different worksheets focus on subjectivity of the knowledge connecting the experiences of different individuals. Now I came to realize that I was moving towards from the concept of technical rationality to reflective practice. Technical rationality is replaced with the concept of reflective practice which encouraged me to become an active inquirer in complex situations of teaching as reflective practitioners, in which my professional practice could be characterized as reflection in action and action in reflection (Schon, 1993 as cited in Qiquan, 2015). As an active inquirer and reflective practitioner, I thought I was moving towards teacher researcher and becoming a facilitator rather than mathematics teacher.

Next day, which was the very first day of school, but it was a holiday for children, I spent my first one-hour to introduce with each other and had lunch together. After that, teaching staff started preparing their teaching materials, curriculum, planning, etc. It looked like they were becoming ready to work with children. I also went to the library, searched for mathematics textbook, curriculum book as I instructed. I found many mathematics textbooks from different national and international authors. I was shocked as I did not get the mathematics curriculum of any grade in the library. I came to know from the mathematics teacher of primary grade, the principal herself supervised the mathematics teacher to prepare the required materials in teaching mathematics such as lesson plan, materials, and to some extent

curriculum. While I was talking with them, my supervisor came into the library and said:

Principal: *Laxman, did you get the mathematics books of middle school?*

Me: *Yes ma'am.*

Principal: (*By giving around 3/4 pages of the printed document) Laxman, this is our mathematics curriculum of grade seven. Please first prepare an annual plan, then unit plan based on this curriculum and send an email to me. I will revise if necessary and will forward to your email. After that, we work together on the lesson plan.*

Me: *Sure ma'am. I will do it by tomorrow.*

She went to her office. I was surprised that I never learned before about the national mathematics curriculum prepared by the school principal. However, I thought that she photocopied the mathematics curriculum from the curriculum prepared by the Curriculum Development Centre (CDC) separately and provided it to me. Thoroughly, I read the document. Most of the contents I found different than that I learnt and taught before. The language written in the paper was quite different than our context (for instance, instead of Rupees there was the symbol of Dollar ($) and Euro, the name of person was not related to our community). Arriving at this stage, I developed the images of mathematics *curriculum as dollar-based document that* rarely provides the opportunity to students to learn about the national economy knowledge, culture, etc. and leading towards the culture of Western society. Indeed, the existing mathematics curriculum in Nepal also incorporated mostly the contents promoting Western Modern worldview, thereby subordinating Nepali Cultural Worldview (Luitel, & Taylor, 2008). However, education is not only what people in Western societies associate with public schooling or university (Newell, 2014) but education is what people in their own societies associate with culture, diversity,

schooling and university, in which mathematics curriculum and mathematics education can play an important role to make us aware of our cultural activities and rituals.

Then I met Nepali and Science teachers and talked about the curriculum. They showed the curriculum prescribed by the CDC provided by the respective subject supervisor. I was again surprised. Some questions came to my mind. Why did I not get the mathematics curriculum provided by the CDC? Did she revise herself the mathematics curriculum? If so, why were the subject teachers ignored for revising the curriculum? I kept that mathematics curriculum in my bag and returned back home. It was around 5 pm. I reached home. A few days ago, I had taken the Indian mathematics textbooks of grade seven and grade eight of my brother. He has completed the secondary level education from Central Board of Secondary Education (CBSE) which is a national level board of education in India for public and private schools, controlled and managed by the government of India. I looked at the table of contents of the book which was almost the same as the document given by the principal known as national mathematics curriculum of grade 7. I wondered. I began to raise the question, was the school mathematics curriculum of Nepal prepared on the basis of foreign mathematics curriculum? Or is it the same as CBSE mathematics curriculum? Or are the mathematical symbols, a mathematical problem, mathematical contents etc. derived from India? Further on reflection, was the mathematics curriculum prescribed by the CDC not relevant or de-contextual? Actually, the above situation made me understand the mathematics curriculum as foreign subject (Luitel, 2009).

Continuing my early images of mathematics curriculum as I discussed above with *mathematics curriculum as dollar-based document* as well as foreign subject

(Luitel, 2009) reinforced me to be away from day to day activities, cultural context, etc. Moreover, it was difficult to give the mathematical problem related to our day to day activities as well as the examples related to our context on the basis of the curriculum.

However, as a reference-students and myself were using the mathematics textbooks written by Nepali author which made me a little bit comfortable. Those kinds of activities have proved the statement as mentioned by Luitel (2003) that "the school's inside was not as beautiful as the outside" (p. 13). This statement does not talk about the floor of the school building, old wooden desk and benches of the classroom, broken windows, a roof with cracks, discolor painting of the wall of the classroom, etc. but talks about the colors of pedagogy, variations between activities, like the diverse nature of students, and so on. I did not enjoy a lot as I enjoyed listening to someone about school.

To balance the inside and outside beauties of the institutions, there should be cultural and contextual activities from the papers to the action. The educational process should be rooted in the complex, uncertain, instable, unique, and value-conflicted practical situations (Hua, 2015) which make mathematics class a place to reflect the cultural activities via problem solving and story-telling rather than narrating foreign mathematical symbol and definition. In this regard, reading Master's research project of Luitel (2003) became a reference of my images of mathematics curriculum as foreign language. He mentioned that "…during the last week, whenever I opened my mathematics book my brother's answer, because it is foreign, therefore, it doesn't have any stories to my questions: why are there no stories in my mathematics textbook?" (p. 12). Reading this story really made me thoughtful and many questions came to my mind. Was that an output of foreign mathematics

curriculum? Were there no stories of foreigner?, etc. Moreover, encountering mathematics as foreign language reinforced me to stay away from my heart, spirit and cultural context (Luitel, 2009) and started to think mathematics as meaningless, symbolic as well as foreign text.

Curriculum as a Sequence of Algorithmic Problems: Teaching as One-Way Narration of the Problems and Solutions

If mathematics textbook is taken as important and necessary resource in teaching and learning mathematics, then who is responsible for selecting and what is the basis to choose the mathematics textbook in school? Because there are many mathematics textbooks available of the same grade written by different authors. In the context of Nepal, this question is more relevant to ask institutional school's teacher/leader than the government schools' teacher/leader. In our context, number of textbook writers are increasing day by day and they publish through private publication and recommend to the institutional schools approved by the Curriculum Development Center (CDC). Economically those books are expensive and almost served by the previously discussed images (*as textbook, foreign subject, culturally reproduced, dollar-based document, etc.*) of mathematics and mathematics curriculum.

It was a sunny day in May 2018, we mathematics teachers were sitting and talking about the new academic session 2018/19 inside the mathematics lab at Annapurna School located in the Kathmandu valley. There was one week left to

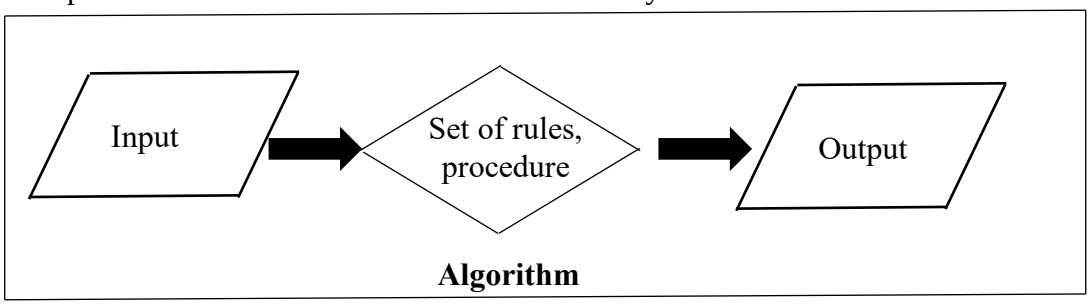

Figure 11

welcome the students for new academic session 2018/19. Thus, we were planning and preparing some fun and engaging activities for children for the first one week in which the students enjoy a lot. In the meantime, Mr. Facilitator (who is one of the members of school management committee who collaborates and organizes a weekly meeting with mathematics teachers) came inside the room.

Teachers: Good morning sir!

Mr. Facilitator: Good morning teachers! How is everything going on? I hope you are ready to welcome the students.

Teachers: Going well, sir. We are preparing some fun activities in math to welcome the students.

After that Mr. Facilitator started to talk with one of the secondary level mathematics teachers, the Head of the Department (HOD) of mathematics about the mathematics textbook.

Mr. Facilitator: Sir, which mathematics textbooks are we going to choose for grade nine?

HOD: I have not thought about it yet sir. Ok, we may use that has been used this year. Or which book do you want to refer?

Mr. Facilitator: (By showing the book) it is written by Mr. Friend who is teaching mathematics for more than 15 years. I also worked with him for about ten years. I know him properly. I think it is fine. Could you please see the book once because we have to finalize mathematics textbook for grade 6 to grade 10 by tomorrow?

After 5 minutes…

HOD: It seems fine sir. The problems are also enough for the children to as well as examples are also given nicely. What do you think about this sir?

Mr. Facilitator: I also think the same. It's ok. I believe that he has included more mathematical problems that help to engage students properly (seeing the table of contents). Similarly, he has included additional practice questions as well so that students do not need to search for other additional books or materials to find the mathematical problems.

Above discussion shows how the mathematics educators in school select the mathematics textbook. Selecting textbook based on algorithmic problems as well as taking it as a process of maintaining relationships really kill the students' creativity and their mathematical skills as well as mathematical literacy. Basically, algorithmic problems expect some certain process or rules to solve. As shown in the figure 11, teacher can orient students about the rules and procedure as input and students need to follow those rules and procedure (called algorithm) to obtain the expected outcome. Similarly, that way of selecting the textbook might promote the thinking that "school as a business" (Pinar, 2004) in which teachers become the recommenders and students become the customers. Students are forced to buy the textbooks recommended by the teachers. Those textbooks with many mathematical problems may not be related to our/their context, and prepare teachers to assign and recommend the mathematical problems from the textbook to solve rather than create the environment to construct and create the contextual mathematical problems. It is being interesting and to some extent funny to share that in the context of Nepal. Some of the mathematics teachers themselves as textbook authors usually force their students to buy those books.

Moreover, my experiences of teaching and learning mathematics depicts that some of the institutional schools in Nepal are likely to select the mathematics textbooks based on their interest either whether they are effective for children or not. So the outcome of teaching and learning is not as expected, thereby the situation

occurs when teachers are blamed by students. In this context, Rivera (2011) mentioned that many middle school teachers complain that students too frequently make the errors of conducting that $a^m = a \times m$, where a and m are real numbers in which two popular errors are $2^3 = 6\ and\ 2^0 = 0$. Those types of errors in different topics of mathematics are made by the students of primary and secondary level students as well. In my opinion, this type of condition is happening day by day because of focusing on the algorithmic problems, readymade mathematical problems, rote memorization instead of focusing on creativity, imagination as well as experiential based learning.

Next, following algorithmic problems which are far from students' daily experiences and cultural activity need certain standards and process to solve. Those standards and process are to be required for all types of learners. More precisely, students those who achieve average, below average, and higher than average required same standards and problems solving process for a particular problem. Based on the textbooks, students are assigned to some algorithmic mathematical problems expecting to solve maintaining certain standards and procedures. In this context, Wolk (2011) mentioned that:

> Standards-based accountability has been widely embraced because there is a certain logic to it: decide what every student should know and be able to do; formulate a rigorous curriculum to ensure that students get the designated knowledge and skills; use standardized tests to assess them yearly to make sure they are succeeding; punish them at the school if they fail to meet the standards. (p. 24)

However, the textbook is important for self-learning and it is better to use it as a reference. In my opinion, giving priority to the mathematical problem without

looking at context, real-life examples, as well as experiences and level of students, was not the proper way to select the textbook. On reflection, are all the mathematics textbook written on the basis of the curriculum? Is it organized in simple to complex way? Did the mathematical problems given in the book enhance the students' cognitive, affective and psychomotor domains? Are the problems given in the book real, contextual and related to the students' experiences? Is it impossible to conduct a field trip and prepare worksheet? Thinking, curriculum as only the sequence of mathematical problem is more guided by the technical interest of Habermas and promotes teacher to read and narrate the problems from the textbook as well as leading towards exam-oriented education which assess students' ability and capacity in particular area or subject matter. In exam-oriented education, teaching is concentrated on the textbook's readymade problems, relies too much on subject-specific curriculum, destroys and ignores students' interdisciplinary interest and abilities, essential to their academic and social development (Qiquan, 2015).

Parental View of Mathematics Curriculum: Curriculum as Textbook

I have discussed curriculum as textbook and associated pedagogical and assessment practice in the previous chapters on the basis of my experiences of learning and teaching mathematics. One of the factors that affects di/indirectly as well as positively or negatively in the student's learning is parental education. Parental education sometimes can play a motivating role to the teachers and sometime demotivating. However, everything may depend on teacher parent communication, teacher and parent education as well as connection between teacher, parents, students and school administration. In this context, I share one incident that shows how parents think about teaching mathematics and textbook as well mathematics curriculum.

It was a day of August, 2018. There was a small program organized by the grade six students in school, which was related to the English literature. Students themselves with the support and guidance of the teacher prepared the book on different topics. Now I like to say that, it was the program called book exhibition conducted by the grade six students. Parents and other stakeholders were invited to observe. They observed and gave feedback positively despite their busy schedule. It was about 10 am clock in the morning, most of the parents came to observe and went to their work as most of the parents were job holders. So it looked like rush and crowded on the front ground of the school. We teachers carefully observed the parents how they enjoyed their child's work. On that occasion, some parents came to me and talked about the achievement in mathematics of their child and some parents just observed the program and went out. During the program, I found such parents who encouraged me to conduct such types of programs in mathematics as well as there was a parent who did not like those types of program in mathematics. I saw one of the parents (called Mr. Officer) around 60 years old came with sad face and moved around the program, stopped around one minute in front of his son's stall and returned back to me. However, we knew each other properly as he was one of the retried government officers. I greeted him and he responded to my greeting positively. He showed his angry face to me, especially about the program. It was clear that he did not like the program. In his words, it was a kind of drama which Mr. Officer was telling me: *Sir, I don't know either this program is beneficial to the students or not, but students (my son) really missed their classes like mathematics, science and other. Exactly, but they enjoy sharing what they have done in literature. They love to learn outside of the classroom. At the same time, they are accepting the feedback of the*

visitors that help them to shape their knowledge as well as they are also developing their communication skills. I replied with smiley face.

After that Mr. Officer started to talk about the mathematical content and topic that I taught in the grade six. I was surprised to hear that:

Sir, you did not teach everything whatever given in the textbook. You skipped some of the topics and problems… how they prepare or are capable of being in the upper grade? How did they face the Secondary Education Examination (SEE) and District Level Examination (DLE), now called Basic Level Examination (BLE) *in grade 10 and grade 8? Did you know sir, during my schooling my teacher forced me to solve every problem given in the textbook so that I passed the examination easily because of that hard work I worked for many years as police officer in Nepal.*

His way of talking and expressed words tried to focus on the 'important points' and 'difficult points' of the mathematics curriculum. The "important points" refer to the crucial contents in the subject matter, and the difficult points refer to those content that students may be confused about" (Xiangming, 2015, p. 197). So, Mr. Officer suggested teaching all the contents given in the textbook taking as important in which students cannot solve without the presence of teacher. Next, the beliefs as like Mr. Officer promotes the thinking that mathematics is future career subject and might help to generate highly payable and prestigious job. In reality, most of the parents' interest is like that in which some of the parents express easily and some do not. But this hidden interest somehow becomes fruitful for some parents (as well as for me) but it exactly would not be able to foster the pure interest that is more motivating, empowering and authentic (Habermas, 1972). These beliefs and perspectives of parents towards mathematics generally orient the practitioner teachers to control and manage the environment for short term personal benefit in which

lecturing, narrating the content and procedure become the main approaches of teaching.

In my opinion, to overcome such types of beliefs and perspectives towards mathematics of parents, involvement of some representative parents in curriculum development process might be necessary and important. Moreover, mathematics curriculum making may begin with building relationships with parents/families and getting to know them, for example, by making home visits, attending community and cultural events in which parents are engaged, hosting community building events at school, etc. in which curriculum makers gain the knowledge which they can use to make curriculum which draws on the lives of the children and parents (Pushor, 2013). Thereby, it might be helpful to incorporate cultural perspective of mathematics, experiences of parents and child in school mathematics curriculum.

However, I tried to convince Mr. Officer by talking about the mathematics curriculum, teaching strategy, work sheet as well as project work that I have used in the classroom. Further I said to him *sir actually we are following our mathematics curriculum prepared on the basis of national curriculum, whatever suggested to be taught or based on the learning outcomes in the curriculum we have selected content and planned accordingly to teach. The teaching approach and learning style are different than traditional learning and teaching style which we experience and every content given in the textbook may not be in the curriculum so that it is not necessary to discuss in particular class.*

He became quiet for a while and replied; *I don't know about curriculum and I have never seen it till today. For me, everything is textbook either it is itself a curriculum or not. What does curriculum mean?* As I mentioned above, parents' involvement as well as incorporating societal knowledge is now necessary in our

school mathematics curriculum. In this context, Moll, Amanti, Neff, and Gonzalez, (1992) also mentioned that curriculum making may be extended further by inviting parents and families into the curriculum making process and drawing on the wealth of parents' knowledge (as cited in Pushor, 2013) so that parents are able to know the school mathematics curriculum and may become responsible to their child's education.

Arriving at this stage, I mention that Mr. Officer is one of the representative parents who believed that mathematics textbook is itself a curriculum though he is educated. So his intention was or the parents' intention was to conceive teachers to convince what they experienced. Thus, we teachers are conceived by the demands of parents, administrators, policy makers and politicians (Pinar, 2004), thereby teachers in Nepal are not more autonomous during the selection of pedagogy, materials as well as assessing the students. This is one of the examples of what parents have believed about the curriculum and text book even if they are from the urban and developed areas of the Nepal as well as from educated family. If so, what is the situation of the school, parents and students of the rural area of the Nepal of both community and institutional schools? Are they aware of mathematics curriculum which is prescriptive in nature? Really there is a miserable condition of the education system, especially in mathematics education in which thought process and belief system of the parents and other stakeholders in/directly affect the student's learning in mathematics.

However, one of the reasons to think like that is prescribed curriculum or official curriculum in which, most of the people do not know where it is prepared and who prepared. Moreover, lack of understanding of what actually curriculum means leads parents, teachers, as well as other stakeholders towards the thinking which may narrow down the essence of curriculum. In fact, school curriculum in general and

mathematics curriculum in particular, “communicate what we choose to remember about our past, what we believe about the present, what we hope for the future” (Pinar, 2004, p, 20) instead of focusing on what we choose to remember about our and their past. Further, the model of curriculum itself is a deductive and generally includes four fundamental processes and they are objective selection, content selection, sequencing of the contents and then evaluation. Moreover, deductive model for curriculum development proceeds from developing the curriculum first by expert and then moving towards implementation of it. So this model of curriculum development somehow restricts the educators and learners to choose suitable learning activities during teaching and learning process. Because of this, there will be less revision and local mathematical knowledge cannot be incorporated which is useful in day to day activities. However, Oliva (2001) mentioned that curriculum development is the process of making programmatic decisions and reviewing the product of those decisions on the basis of continuous and succeeding evaluation (as cited in Jafari & Kaufman, 2006)

The above images of mathematics curriculum that I discussed are more guided by the technical interest. One of the orientations of such images of the curriculum is to control the groups of people and the society. Such images or understandings of mathematics curriculum orient mathematics teachers to form the certain rules and regulations or establish a law which is applicable to control. Moreover, the technical interest is one which comes from inclination, not from the reason (Grundy, 1987). Thus, the curriculum making process is guided by the feelings and thoughts of the curriculum maker instead of the feelings and thoughts of the students as well as related to the context. Further, the action guided by the technical interest is constituted by a number of elements known as the *edos* and the *techne* which together provide the

basis for action (Grundy, 1987). The *edos* or the guiding idea prescribes the nature of the product, not the skills. Thus, one of the definitions guided by the *edos* of technical interest is that all the planned exercise provided by the school assist the pupils in attaining the designated learning outcomes to the best of their abilities (Neagley & Evan, 1967 as cited in Grundy, 1987). In this regard, the mathematics teacher is required to exercise his/her skill or can play a role of a narrator by narrating the text, formula, theorems, etc. to reproduce the mathematical content, lecture, mathematical problem, exercise, etc. There is a rigid assessment system in which the students' intelligence towards mathematics is judged by his/her performance of the summative test. Moreover, the word curriculum design and framework of curriculum, etc. are the technically oriented words and focus on a product-centered approach to curriculum. The objectives are pre-determined which determine the design of the learning experience and the selection and organization of learning experience depends upon the skill of the curriculum designers.

Deliberating into Pedagogical Practices: Teaching as One-way Narration

The above images of mathematics curriculum enable teacher educator to promote the images of teaching: *teaching as one-way narration.* As shown in the figure 12, the role of teacher might narrate the steps or procedure of the problem and the students just copy the narrated procedure. This image of teaching might not provide the learners with the opportunity of involving them in planning the learning task, which they have to accomplish. But "curriculum theory understands teacher education as engaging prospective and practicing teachers' self reflexively in interdisciplinary study, study often located at the intersection of self and

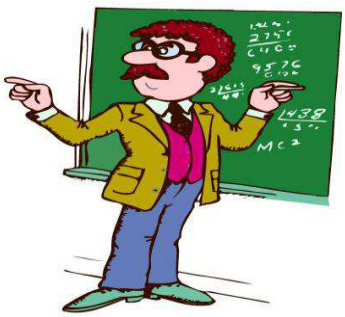

Figure: 12

society, the local and global, the school subjects and everyday life" (Pinar, 2004, p. 23). While connecting this curriculum theory stated by Pinar into teaching mathematics, teacher should reflect upon past experience and plan for future goal, respect the voices of students or provide such a platform where students freely share their constructive knowledge and experiences. Decision making process should be based on the opinion of teachers and students on particular content which can articulate and respect the local and global both mathematical knowledge as well as play a role of bridge between everyday mathematics and school mathematics. Thus, curriculum theory might not promote mathematics teacher as/for narrator and teacher education is for promoting the disempowering images of teaching like *teaching as narration*.

In this context, Freire (1993) mentioned that narration with the teacher as narrator leads the students to memorize mechanically the narrated content. Thus, the role of teacher is to teach and students are taught, teacher thinks that students know nothing but teacher knows everything, teacher narrates the content and students listen. Further, narration in which the teacher as narrator leads the students to memorize mechanically the narrated content, thereby turns students into containers to be filled by the teacher (Freire, 1993).

While suffering from the narrative sickness of teaching mathematics, listening to the key notes of Rochelle Gutierrez (University of Illinois at Urbana- Champaign) on 10th International Mathematics Education and Society Conference, which was held on Hyderabad India at January 28th to February 2nd, 2019 became eye opener key notes for me. She has talked about humanization of mathematics as well as how mathematics is being dehumanized day by day. What could be the role of teachers, mathematics curriculum, students, parents, and other related stakeholders? She

mentioned that mathematics dehumanizes day by day by privileging: (i) algebra/calculus over geometry/topology/spatial reasoning/discrete mathematics (ii) rule following over rule breaking (iii) western-mathematics over ethno-mathematics (iv) standard algorithm over many possibilities (iv) abstraction over context (v) mind over body (vi) logic over institution and so on. In my opinion, the above discussed images of mathematics curriculum might play an important role to dehumanize the mathematics and mathematics pedagogy by promoting and motivating privileged things which are discussed by Rochelle Gutierrez.

In my opinion, privileging those things promotes to incorporate the narration approach of teaching by privileging the traditional pedagogy such as lecture method as well as privileging standard algorithm over many possibilities enables teacher to follow the standard process given in the textbook and promotes teachers for summative assessment. Students as well as teachers may constrain to look over the alternative idea and possible options to solve the mathematical problem which might come from experiences of the students and teachers as well from cultural perspective. As Gutierrez (2019), my perspective is to encourage mathematics teacher educator to move beyond a practice of mathematics where human remains at the center and where a single ontological or epistemological perspective is dominated, thereby curriculum may become flexible, changeable, and teacher can students friendly, culturally responsive, then teaching may become constructive and meaningful rather than mere narrative.

Twenty first century education needs the teaching and learning for understanding, sharing and meaning making. Teaching and learning should be based on collaboration among students, teachers, parents and other stakeholders. Students should engage in critical thinking, creativity, imagination, etc. which might be served

by the problem posing pedagogy as discussed by Paulo Freire, in which problem posing educators constantly re-form their reflection in the reflection of students, students are no longer docile listeners but are critical co-investigators in dialogue with the teachers (Freire, 1993).

Key Message of the Chapter

The highlights of this chapter include understanding of mathematics curriculum as I would like to say that images of mathematics curriculum by myself and teacher educator that I represented on the basis of my experience of different stages of teaching mathematics. Mainly, I have focused on how teaching mathematics is becoming the process of narrating the content and procedure in the classroom instead of making meaning and understanding. What was/could be the role of present mathematics curriculum?, etc. As per my view, curriculum is an important part of teaching and learning mathematics but it might be becoming very harmful to the learners because of lack of understanding of what exactly curriculum and curriculum theory are. Also, the essence of this chapter is to make the readers aware about the present mathematics curriculum and their impact on teaching mathematics. I have tried to explain the narrative sickness of mathematics education created by the prescriptive nature of mathematics curriculum and suggested to practice the problem posing pedagogy by revising and revisiting the mathematics curriculum on the basis of context.

In next chapter, I continue to discuss the problem posing pedagogy and other related student-centered pedagogy, student/teacher centered mathematics curriculum and assessment on the basis of different curriculum images that I (other teacher educators) experienced during educative journey.

CHAPTER VI

MOVING TOWARDS PROGRESSIVE IMAGES OF MATHEMATICS CURRICULUM

During my experience of teaching, I got opportunities to participate in a teacher professional development program on different topics such as the uses of curriculum and teacher guides, material development and, STEM/STEAM education, etc. Similarly, I planned and structured mathematics curriculum which is prescriptive in nature. However, only in some schools, I was free to articulate the activities and pedagogies based on the availability of resource and experiences of students as well as on the basis of specific needs and interests of students which have not been mentioned in the prescribed school mathematics curriculum.

Moreover, the knowledge gained about pedagogy, assessment, and curriculum during my Masters and MPhil at KUSOED enabled me to analyze the present mathematics curriculum. I sometimes started to critique and raise the question to their practice and structure. It gave positive energy to revise the existing mathematics curricula to make it contextualized as well as students and teacher friendly. Further, participating in different national and international mathematics education conferences enabled me to broaden the ideas and knowledge about mathematics education, mathematics curriculum, pedagogy and assessment. My thought and beliefs towards mathematics curriculum, pedagogy and assessment have been changed from conventional pedagogy such as lecture method based on deductive approach to progressive pedagogy such as collaborative, activity based, critical and based on inductive approach.

Not only this, getting workplace having school leaders and staff with progressive and flexible thought enabled me to apply my constructed and updated as well as revised knowledge in the real field of mathematics education. Thus, this chapter portrays my endeavor towards making teaching and learning more progressive and experiential with reference to practical interest of Habermas (to some extent emancipatory interest as well) based on the research question: How have I been transforming towards valuing the progressive images of mathematics curriculum from conventional curriculum images? The main constructed images of mathematics curriculum in this chapter are: *curriculum as lived experiences: promoting learning as coming to know, curriculum as action, curriculum as collection of art, curriculum as interdisciplinary content knowledge,* etc.

Joining an Experiential Learning Based Schools: Opening a New Avenue

While I was a fourth-semester Master's student of mathematics education at KUSOED, one of my friends informed me about the vacancy of a basic level mathematics teacher in a school inside the Kathmandu metropolitan city. He knew about that school from one of the visiting faculties of KUSOED. So I tried to understand more about the school through the related person who suggested joining there with an advice: '*This is a good opportunity to do something unique and learn new things.'* So I decided to leave the school where I was working and formally joined *Kanchenjunga* School (also known for an experiential learning school) from April 10, 2016. During my Master's at KUSOED, I participated in discourses on present education system of Nepal, especially on different dimensions of teaching mathematics and mathematics curriculum with teachers, professors, teacher educators, and friends. I thought that newly joined school could be one of the places to share and implement what I learned at KUSOED.

Moreover, as I groomed up in disempowering culture of pedagogical practices during my schooling that have some sort of impact on my beliefs and practices towards mathematics. Being a graduate of Master's level in mathematics education from KUSOED to some extent has enabled me to minimize those negative beliefs (such as mathematics as culture free subjects, male dominated subject, etc.) toward mathematics. Therefore, I expected that the school would provide me such an environment in which I could develop the progressive images of mathematics and mathematics curriculum through the empowering and inclusive pedagogy probably based on social constructivism as a philosophy of mathematics.

I accept that the human language, rules and agreement play a key role in establishing and justifying the truths of mathematics (Ernest, 1991). After getting one-year experience of progressive thought of school educators, parents, students as well as other stakeholders, I joined another school which has been seeking collaboration and cooperation with stakeholders, policy makers, teacher educators, parents, etc. to incorporate progressive pedagogy in school. The blended form of the pedagogy of instruction and the pedagogy of construction (Presmeg, 2014) enabled me to fulfill the learning outcomes of mathematics by maintaining a balance between traditional and progressive pedagogies.

Further, discourses related to the issue on Nepali mathematics curriculum, assessment, and pedagogy during my M Phil courses at KUSOED empowered and motivated me to move ahead by critiquing and modifying my existing beliefs and knowledge towards mathematics education, pedagogy, and nature of mathematics, thereby continually seeking humanizing pedagogies instead of de-humanizing them. Besides some faults and errors, newly joined semi/progressive school has been giving the priority to students' specific needs and interest, 21st century skills through the

variety of pedagogical aspects in mathematics classroom. Moreover, it also helped me to change my concept from the school as industry to school as a home, teacher as a jailer to teacher as parents and the students as passive listeners to active learners. The beliefs of schools towards mathematics curriculum and pedagogy not as like stated by Luitel and Taylor (2007) in which curriculum as a detached substance and the process of developing a curriculum as an activity separated from teaching as the school has provided lots of trainings each year regarding the relation between curriculum and teaching. Thus, we teachers also realize that process of curriculum development is not an activity which is separate from teaching and learning. To show the relation between curriculum and teaching, every year, at the beginning of the new academic session, each grade of the school has been organizing the program called 'Curriculum Eve', in which parents are invited and teachers of each subject explain about their subject curriculum which has includes pedagogy, assessment system, activity, educational trips, etc.

Teachers and students as well as parents till today are not getting the opportunity to involve in the development of mathematics curriculum. It is difficult to say the exact reasons why teachers and students are always taken out from the development of curriculum as well as policy related to the school and curriculum. In the context of Nepal, most of the community schools' teachers who are in ruler area might have difficulty to assess the mathematics curriculum on time, thereby they forced to follow the mathematics textbook. Because of lack of good transportation, geographical difficulties, lack of awareness, lack of supervision, etc. are some reasons of unavailability of curriculum in rural community schools. However, community as well as institutional schools' teachers who are in urban or near the urban area might get the prescribed mathematics curriculum prepared by so called 'expert' which does

not serve the particular interest of 21st century's kids. Thus, teachers, students as well as parents have still believed that the mathematics curriculum is *expert-assembled knowledge, monocultural text* (Luitel &Taylor, 2007). Thus, teachers' image is not only an implementer of prescribed curriculum but also a 'policy propagandist' (Hua, 2015).

The majority of school in Nepal and educators still believe that curriculum is not attached directly to the school and school teacher but attached to the curriculum experts and policymakers. Moreover, bureaucratic, hierarchical and repressive culture has shaped and facilitated the thinking and action of Nepali experts (so called) who work in the field of curriculum experts (Luitel & Taylor, 2005). This is one of the reasons why Nepali school teachers are always suppressed from the process of curriculum development. In this context, it is good to see the opening new institutional school with semi/progressive thought which can play an important role to shift the traditional practice of education to modern as well as progressive education.

Curriculum as Lived Experience: Promoting Learning as 'Coming to Know'

Joining the school which has still been moving towards to incorporating student centered pedagogy in mathematics motivated me to re-think about the discourses that happened during my Master's and MPhil class of mathematics education at KUSOED. Rethinking on those discourses related to the mathematics curriculum, pedagogy and assessment enabled me to critique the practices of designing mathematics curriculum, ways of assessing the students' learning outcomes, as well as teacher-centered pedagogy which have been rooted in technical interest of Habermas and emerged many questions in my mind: does present mathematics curriculum fulfill the 21st century skills of children? Does it fulfill the children's ICT skills in this rapidly changing world? Does it help children to solve the

social problem that may occur at home, market, etc. during traveling, shopping/buying or during socializing? Is it being the source of inspiration for students for future employment and career paths?, etc.

Actually, at the beginning of the new academic session in 2018 A.D, at newly joined school, around ten days were given for us (teachers) to prepare the sequence of curriculum on the basis of prescribed curriculum prepared by the expert of CDC that has been used to teach mathematics throughout the year. Different research findings indicated that in order to maximize students' engagement with the subject, content selection should be realistic and relevant to their experiences and aspirations for future employment and career paths (Macintyre &Hamilton, 2010). Keeping this statement in my mind as well as critiquing and analyzing the recent practice of teaching mathematics, I included activity with resources which are related to the real-life situation, which may or may not be experienced by the students. For instance, activity using algebraic tiles in algebra, activity with the real wooden solid shapes, etc. Moreover, possible ICT tools and software such as computer, projector, GeoGebra, Google Sketchup, etc. which have helped to enhance the ICT based pedagogy. Further, possible project work, group work, pair work, field trip, possible resources to be used or possible pedagogy which increase the number of students in the activity were not mentioned in the present mathematics curriculum wisely and contextually.

Doing these activities helped me to orient towards a constructivist teacher-researcher. In the point of constructivist view, teachers should continually make a conscious attempt to see both their own and children's actions from the children's point of view (Cobb & Steffe, 2011). It emphasizes that communication through different teaching and learning activities rather than semiotic and abstract between

student and teacher is important. Moreover, it made me responsible towards learners and believe that our national curriculum does not serve skills and knowledge for the holistic development of the 21st century's children. I came to realize that preparing the activity as well as choosing the pedagogies for teaching children in the mathematics classroom, to some extent serve the students' experiences, needs as well as the interests which are very essential to motivate children to learn mathematics. The materials I prepared trying to portray as mentioned by Schubert (1986) that each learner is deemed unique and worthwhile. It means that each learner has his/her own story of life, own way of expressing and understanding. Thus "one size fits all pedagogy" may not be appropriate in the classroom but it becomes just a waste of time and loss of energy of teacher as well as students. Not totally but to some extent, I got an opportunity to value the statement that curriculum is meaning experienced by students, no facts to be memorized and learning experience is the curriculum that students actually come to know or realize as stated by Schubert (1986).

Moreover, the curriculum is meant to be experienced by students, not facts to be memorized or behavior to be demonstrated (Schubert, 1986). Students will be engaged on the basis of their experiences and prior knowledge that enable them to construct new knowledge. So this image of the curriculum emphasizes that curriculum is a matter of experiences rather than the set of activities (Luitel, 2018) and curriculum has ever been developing in the means-ends continuum (Schubert, 1986). The learners have a key role in the learning process rather than the teacher. In this context, I agree with the statement stated by Lamichhane (2019), curriculum as experience in which teachers and learners' experiences, worldviews, social and cultural aspects, and their needs and aspirations are recognized as source of

knowledge. The following emergent themes with constructed images of curriculum might give the essence of curriculum as lived experiences.

Curriculum as Action: Engaged through Educational Exposition

One of the school events called educational exposition was mentioned in the school calendar. Accordingly, we all teachers started to work on it from the very beginning of the academic session 2017/18 AD. During the preparation of the unit plan of each topic of mathematics (as well as other subjects), (we) teachers mentioned and explained properly about the role of students and teachers in specific content which could help to connect into daily life. It would also help to make it more practical on the basis of experiences of the students in which the aim of doing it was learning and sharing through demonstration, communication, presentation and model making, with the group of people from diverse culture instead of solving algorithmic problems. Educational exposition becomes the big platform for students, in which they can be able to enhance some 21st-century skills through communicating, collaborating, solving a real-world problem or presenting more systematically and precisely what has been done in the classroom. The above pictures (Figure 13 and 14) also showed that students were engaged in different shapes of tangram particularly to enhance the skills of pattern, geometry, and so on. In this context, keeping my earlier images of mathematics curriculum, I construct the images of mathematics *curriculum as study of patterns, shapes and sizes.* These images of mathematics curriculum are likely to encourage mathematics teachers to connect the

Figure 13

pedagogy to different mathematical patterns and motivate students to solve the problem accordingly.

Further, this is also being helpful for students to think imaginatively and critically. Being critical is not synonymous with being negative, rather critical learners and educators are committed to practices, principles, equality, equity, and justice (Aslan Tutak, Bondy, & Adams, 2011). So they can raise questions themselves on their own work, status quo, taken for granted ideas which have been dominated in mathematics education. Moreover, being critical enables teachers as well as students to develop critical consciousness. Critical consciousness intends to develop the capacity to conceptualize in a way that does not dimly confirm to or accept the given of the society. It encourages students and teachers to question, analyze, denaturalize, decontextualize, and deconstruct the hegemonic political ideologies, religious superstitions and orthodoxies, social cultural practices, and economic forces that have deeply permeated our consciousness (Kumar, 2013) which directly or indirectly affect the field of mathematics education. Consequently, the model as shown above enables the student to do hands-on activity during learning solid shapes. It motivates them towards conceptual understanding, thereby procedural understanding can be developed. Teaching three-dimensional shapes by drawing the figure on the white/blackboard is being difficult to understand, visualize, and identify the features as well as related problem-solving.

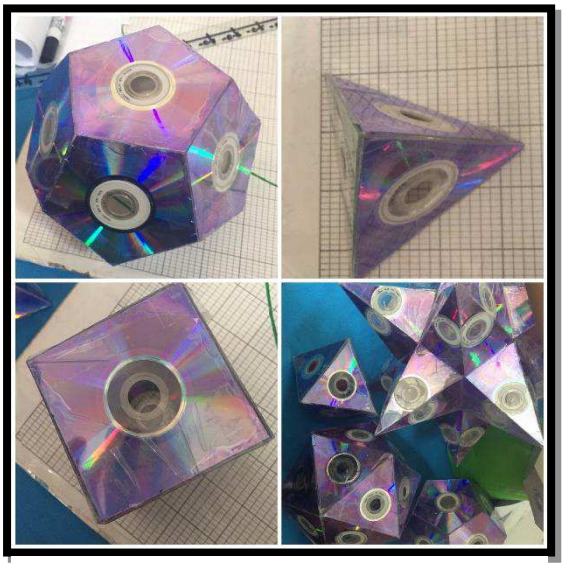

Figure 14

Thus, preparing model and demonstration through educational exposition with its characteristics, possible created problem and ways of the solution are being effective as well as being experiential and practical rather than theoretical. It also challenges the objectivity and universality thought of mathematics by diversifying on the basis of their cultural activities and tradition. Through dialogue as well as communication, students generate and examine mathematical problems from their own lives and work in the team to construct the figure of solution. Educational exposition with lots of activity and model related to mathematics incorporate the waste recyclable materials found around us. So it gave a positive message to teachers, parents, students as well as all the visitors who visited the educational expo, in which no cost and low-cost materials available around us were being effective and useful in teaching mathematics.

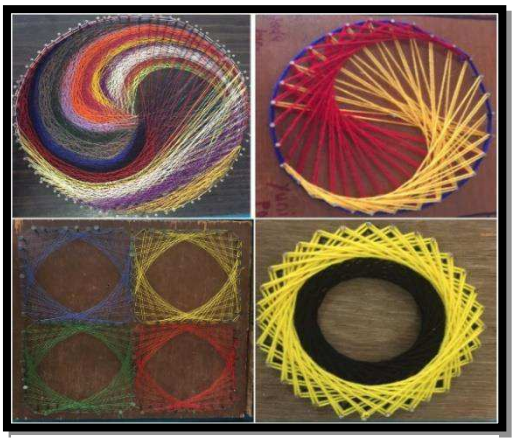

Figure 15

Similarly, I got an opportunity to participate on the program called "Exhibition of Teaching and Learning Mathematics Materials" organized (on June, 2018) by one of the organizations who empowers students, mathematics teachers and mathematics teacher educators motivated me to think *mathematics as an art* in which *mathematics curriculum as collection of art.* More than 20 schools' children participated and exhibited teaching and learning materials related to mathematics. More specifically, as shown as in the figure above (Figure 15) students created the different art works followed by patterns that portray the concept of straight line and curved line with the help of string, pin and wooden pieces. Art based school mathematics curriculum

enables students to demonstrate mathematical skills on the basis of their life experiences. It also helps students to think creatively and imaginatively, thereby develop various strategies of solving a real-world problem. Learners can learn more about him or herself by reflecting on experience with art, particularly when that experience requires action on behavior of the observer (Radziwill, Benton, & Moellers, 2015). Thus, art in the mathematics not only respects students' creativity and imagination but also improves their communication skills through dialogue.

Figure 16

During the observation of the mathematical art (like as above figures), I remembered my learning experiences of line and a line segment. We were not given the appropriate examples of line and told that the line segment is useful to draw triangle, rectangle, square and so on. Nobody told us that we could design such beautiful art in mathematics using the geometrical concepts of mathematics. On reflection, why was it not mentioned in the school mathematics curriculum? Why did educators, and policymakers not encourage and motivate learners to solve the real-world problem through art and pattern? Keeping those questions in my mind, I thought if there is a space of such creative work in every schools' mathematics classroom and mathematics curriculum and then mathematics can be more colorful, interesting and interacting for learners rather becoming hated subject of students limited to problem-solving with memorization.

Further, I could say that Nepal is rich in local cultural wisdom. Mathematical skills are un/knowingly and in/directly embodied in our cultural activities and traditional art. For instance, traditional Newari art is also called Newa art. Traditional Newari art is basically religious art and the religious artwork of the Newari people is

commonly known as 'Paubha' (Shrestha, 2018). Moreover, Shrestha (2018) mentioned that Paubha usually portray figures of important divinities, Mandalas and monuments surrounded by various figures. For the reference, the figure above (Figure 16) is called Sri Yantra (called Mandal wall art) used during meditation to have focus and concentration. Thus, giving place for those things in our mathematics curriculum enables teachers to incorporate our traditional art and patterns through culturally relevant pedagogy.

According to North (2014), Gloria Ladson-Billings first coined the term culturally relevant pedagogy in 1994. She defined culturally relevant pedagogy as "a pedagogy that empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes" (2009, p. 20 as cited by North, 2014, p. 8). It helps students to know the value of mathematics that is embedded in their surroundings as well as can shift the answer to the question why we had to learn particular mathematical topics.

Moreover, there is one kind of understanding of people as mentioned by Rosa and Orey (2011) that mathematics is always taught in school as a culturally free subject that involves learning supposedly universally accepted facts, concepts and contents. Incorporating traditional and cultural art in mathematics curriculum through culturally responsive pedagogy might minimize such conception towards mathematics.

Workshop on STEM Education: Enhancing STEM Pedagogy

It was the first week of November 2018. I was in Jakarta, Indonesia for Science and Mathematics International Conference (SMIC) organized by one of the Universities of Jakarta. I stayed nearby the venue of the conference with my friends. It was the first day of the program, I almost completed preparing my presentation slides

and went to the venue of the conference from the street of Jakarta, which was five minutes of walking distance from the hotel where we stayed. I came to know that my presentation was on the second day of the conference thereby, without any delay I decided to participate in the workshop entitled "A Makerspace Approach for STEM Education" conducted by one of the professors of Deakin University, Australia. Before that, I was not much familiar with STEM which states science, technology, engineering, and mathematics but was interested to participate in the discourses happening at university as well as an educational institution in Nepal.

We around twenty participants participated and were divided into five different groups. The instruction was displayed through the power point in which we had to construct different two models and present with its implication of teaching and learning mathematics. Accordingly, the required materials were available in each group. Actually, we had limited time so we started to prepare collaboratively with group members.

Figure 17

First, we sketched the rough figure of the model. Second, we identified number of required pieces and its measurement in which we were provided one long pipe and that had to be cut as per required. Third, we individually cut the pieces into different eight pieces with different measurements. Finding the length of each piece was really difficult and challenging for us. After that, each of us in our group started to think about assembling the materials which we prepared by cutting. More challenging thing I found was to assemble the things that we prepared. As shown in the above figure, some of us came with the things that we had to make. I found that

some of the participants had difficulties with measurement, difficulties in cutting as well as assembling. Actually, they were seeking help. Similarly, each of us tried to prepare another model as shown in the figure. There were also some difficulties and problem faced by some participants. However, some of us presented the models that we prepared with the implication of teaching and learning, especially in mathematics. The workshop ended with the discussion on some challenges of such kind of STEM-related activities.

Later, I came to realize and constructed the image of mathematics curriculum as *collection of interdisciplinary content knowledge* which is likely to promote the images of *curriculum as agenda for social reconstruction* as discussed by Schubert (1986). These images of mathematics curriculum hold that schools should provide an agenda of knowledge and values that guide students to improve society and cultural institutions, beliefs, and activities that support it (Schubert, 1986) through interdisciplinary content knowledge. The activity I was involved using interdisciplinary content knowledge might enable primary as well as middle and high school students to develop lots of mathematical concepts which motivate learners to develop the social skills and value via set of activities. For instance, it (above discussed) might be effective for primary and middle school students to learn the skills of measurement, angle, assemble and dissemble, etc. practically as well as can make sense of empathy as well as sympathy.

Traditionally, education setting placed students in context that were situated in the classroom separate to the context of the content (Stroud & Baines, 2019). For instance, students might study the area as well as perimeter of two-dimensional objects (rectangle and square) by solving the textbook's problem using formula rather than measuring the length and width of rectangular objects or field. John Dewey

established that education needed a new philosophy of theory that used experience to support the ways in which learners construct knowledge in which emphasis was placed on joining of education and experiences (Stroud & Baines, 2019). In my opinion, STEM activities in mathematics might help to connect the students' experiences to mathematical content.

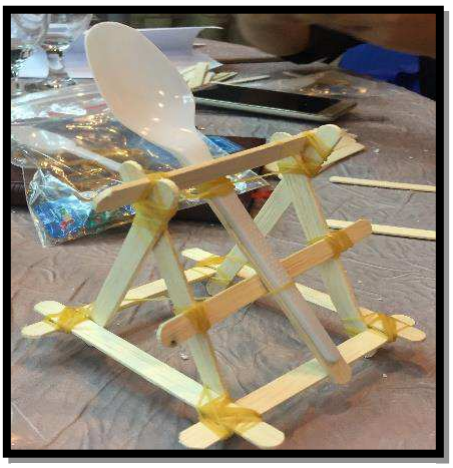

Figure 18

After completing the activities, I came to know what actually STEM pedagogy is. The skill of science, technology, engineering, and mathematics can be used once at a time to promote the child's skills, competencies, etc. No matter which is dominant but it does not limit students to focus on a single discipline. So, it is a multidisciplinary approach of learning and teaching. Thus, I constructed the images of mathematics curriculum as *collection of multidisciplinary text* which might be opposed to other conventional curriculum images such as curriculum as product, textbook, etc. Those, multidisciplinary texts might be articulated from the diverse culture of students which could fulfil the knowledge of science, technology, engineering, and mathematics. Moreover, I came to realize that STEM allows both the students and teachers to be free from the constraints of the static curriculum and promotes to evoke the social norms, justice, as well as promotes to incorporate the social hidden skills through STEM pedagogy. In my point of view, in this 21st century, reflective transformative education and innovative curriculum are needed, with open-ended authentic learning and a multi-disciplinary approach and which is possible through the STEM curriculum. Accordingly, the way of assessing children should be changed.

I found STEM workshop interesting as well as fruitful. That was my one of the eye openers workshops I ever participated. It focused on the interdisciplinary approach of learning, thereby promoting integrated curriculum. Besides some challenges of those approaches of teaching and learning, I realized that something is missing or lacking with the STEM workshop. As it is likely to reconstruct the social skills, norms as well as values, I found it was a bit technical and product oriented which was guided more by the technical interest and less by practical and emancipatory interest of Habermas. To achieve the goals, persons have a basic orientation towards controlling and managing the environment which Habermas calls the technical interest (Habermas, 1972, p. 309 as cited by Grundy, 1987). The environment based controlled and managed by the ideology of people does not respect the humans' feeling and emotions, thereby each participant was working like as robot guided by the notion of competition with each other. However, it challenges the conventional images of mathematics curriculum such as curriculum as subject matter (Schubert, 1996), curriculum as object or thing (Luitel, 2018), etc. and at least started raising voice against the disciplinary approach of teaching and curriculum.

STEM to STEAM Education: Moving towards Humanized Pedagogy

Fortunately, on the same day of having STEM workshop, one of the keynote speakers of the conference presented about STEAM education in which 'A' states for Art. He argued that integrating art in STEM enables learners to value about human feelings, emotions, imagination as well as works on aesthetics parts of teaching and learning. Arriving in this stage, keeping my earlier images of mathematics curriculum, I constructed the images of mathematics curriculum as a *collection of human feeling and experiences* in which classroom is a place of reflecting those feeling and experiences via mathematical activities. Arriving at this stage, by keeping my earlier

images of mathematics curriculum, I can argue that incorporating Arts in STEM likely to fulfill the essence of image of the curriculum as *currere* as discussed by Schubert (1986) and Pinar (2004). *Currere* promotes that curriculum means to run the course that provides a strategy for students of the curriculum to study the relations between academic knowledge and life history in the interest of self-understanding and social reconstruction (Pinar, 2004). Thus, STEAM approach serves the essence of *'currere'* provides students a lot of opportunity to show and reflect their creativity. In this context, Hua (2015) pointed that the basic ingredients of *currere* are recalling one's past; imagining one's future; analyzing and understanding the causes that result in the status quo, including the cause of life success and failure; and acting to create new.

However, STEAM education is not in opposition to STEM education but it enriches and expands the scope of STEM education (Taylor, 2016). Integrating art education is needed to enhance the moral agency of STEM educators besides creativity, innovation, imagination, etc. It also helps people to develop awareness, ethical values, etc. in this period of global change. In this context, Bucheli, Goldberg and Philips (1991) mentioned that the arts can be for both students and teacher, forms of expressions, communication, creativity, imagination, observation, perception and thoughts as well as art can also open pathways toward understanding the richness of people's cultures that inhabit our world, particularly during this period of global change (as cited in Taylor, 2016). Arriving this stage, by keeping my earlier images of mathematics curriculum, I came to realize that the workshop that I participated is likely to serve the essence of curriculum metaphor *curriculum as garden* mentioned by Baptist (2002). Taking all the components such as plants, objects, soil, shapes, etc. which are equally essential for the overall success of the garden. Garden metaphor of

mathematics curriculum is likely to encourage educators, curriculum policy makers, teachers, etc. to incorporate the components of STEAM that might help teacher to be a successful mathematics teacher. Thus, STEAM might enable teachers to stop the causes of dehumanized mathematics education (See chapter VI), thereby promotes the humanizing pedagogy and one of them could be STEAM pedagogy. As garden requires long careful action for plants of flower, including personal attendance with full of solitude (Ibrahim, 2016), garden metaphor of mathematics curriculum motivates teachers to be more flexible, aware of ethics of care, know their students' needs, and respect their feelings as well as experiences.

Further, integrating art in STEM means to develop and support the creativity and productivity of students. "The arts have a way of capturing the essence of an endeavor, reframing experiences, and transforming perceptions" (Stroud & Baines, 2019, p. 1). Thus, art in education in general and mathematics education in particular enables students to reflect and transform their experiences through diagrams, sketches, tables, and other modes of representation such as reflective journal, story, poem, etc. Liao (2016) mentioned that the arts offer an important way to cultivate the creativity of students. By supporting this statement and keeping this into my mind, I claim that creativity, imaginary, social interaction and collaboration can be developed from art education of STEAM. In addition, it motivates students to be a reflective practitioner as well as evoke them to present autobiographical text related to daily experiences of mathematics and solving mathematical problem could be one of the ways of learning. The arts focus uniquely on developing our ingenuity and imagination called creative abilities; beauty and sentiment called aesthetic appreciation; virtues, human rights, and social justice called our ethical values; expression, representation and persuasion called our rhetorical abilities (Taylor &

Taylor, 2019). Thus, STEAM education provides enough space for developing integrated curriculum and constructivist pedagogy with enough space for transversal skills in the school education. In my point of view, arts-based methods in teaching and learning mathematics help teachers and students to be critical, creative and imaginative for solving real-world problems.

Moreover, the STEAM approach of teaching and learning mathematics encourages students to have connection among their knowledge, skills, and abilities and to draw on these connections in advancing their own education and eventually in contributing to a solution to 21st-century problems (Liao, 2016). Most of us are guided by the behaviorist as well as cognitivist theory which cannot more help to create the constructivist child-friendly environment. On that scenario, as said by Gross and Gross (2016), STEAM education has the potential to fulfill the promise of progressive education such as John Dewey and Paulo Freire who foresaw education as moving toward a student-centered model, in which students are engaged and central to the knowledge production.

Unfortunately, Nepali schools follow the disciplinary approach of the curriculum so that teaching and learning activities are based on a different discipline. TPD is based on subjects, and pedagogies are recognized on the basis of discipline, assess the students' learning outcomes according to the discipline, thereby integrated STEAM pedagogy is just limited to the university education, papers, and textbook. However, CDC Nepal has published the integrated curriculum for grade one to three on the basis of the framework provided by national curriculum framework 2018/2019. According to the CDC (2018/2019 A.D) first, it will be piloting for some schools, revise on the basis of comments and feedback and totally implement in all schools in Nepal until 2021A.D for first three grades (grade 1, 2 and 3). While doing so, I

continued to develop images of *mathematics curriculum as dynamic text.* Dynamic nature of mathematics curriculum enables students as well as teachers to incorporate the various content knowledge from different discipline, thereby learning can be enhanced in a better and fun way. In my point of view, this is one of good practices to start the integrative way of learning and teaching mathematics. Thus, students can learn mathematics connecting to their life experiences. Integrative learning empowers students with fewer capabilities to explore a particular area of a field and/or find a place in the field which they can excel (Yakman, 2008). Thus, it helps learners to be a globally competitive citizens as well as helps them to secure a better future. I hope that it will not just be limited to the grade one, two and three but it will be implemented in secondary level as well in future. It gives values of the STEAM curriculum as well as STEAM pedagogy. STEAM education is a curriculum philosophy that empowers and encourages teachers to engage in school-based curriculum development (Taylor, 2016), thereby experiential learning can be enhanced. Similarly, it has been mentioned that project work, classroom attendance, portfolio, creative and innovative work, etc. will be taken for measuring the learning outcomes which are more formative as based on the philosophy of Continuous Assessment System (CAS).

With sharing of the experience of education expo, workshop on STEAM, reading and analyzing the literature, I stopped equating textbook to the mathematics curriculum and started to use the textbook as a resource and prepared many project works (Math learning machine, powered car, etc.), worksheet including games, puzzles as well as real-life problems. I realized that students enjoyed solving the problems followed by patterns and puzzles instead of following a structured process. They were motivated to learn mathematics and develop the ability to solve real-world

problems through project works. Not only that, they enjoyed solving the real-world mathematical problem and the problems they have experienced. I realize that teachers are not only the persons to implement the prescribed documents but also the creator and can play a role as a facilitator instead of a subject teacher such as mathematics teacher (in my case). In this context, Schubert (1986) mentioned that teacher is a facilitator of personal growth, and the curriculum is the process of experiencing the sense of meaning and direction about that is ensured from the dialogue of teacher and students. Thus, working as teacher facilitator enabled me to give the values to students, respect their logical voices and experiences, and prior knowledge.

Moreover, during my mathematics classes, motivated by workshops, educational expo as well conference on mathematics education; I sometimes keep students outside of the classroom to observe and reflect, especially while teaching the topics related to geometry. Students observe and reflect on the basis of their experiences of learning geometry in previous grade and experiences of their daily activities. In doing so, keeping my previous images of mathematics curriculum, I continue to develop the images of *mathematics curriculum as an interactive-ways of teaching and learning* (Luitel & Pant, 2019) which is oriented towards process rather than product. The process-oriented view of mathematics curriculum suggests that the curriculum means not only the document provided by the curriculum experts but also all activities conducted in the school premises for the holistic development of the child (Luitel & Pant, 2019). Education is far more than classroom activity, students' desks, and orderly day as viewed by Newell (2014). By supporting Newell, I have been taking students for an educational tour to explore some historical places which are mathematically rich as well as enable students to observe mathematical exhibition by the different community and institutional schools to think mathematics from

outside of the book. I realize that it does justice to their experiences, right to visit the places and communication with others.

Similarly, it helped students as well myself to bridge the gap between everyday mathematics and classroom mathematics. Moreover, collaborative problem solving really encouraged and empowered them to learn mathematics rather than individual problem-solving. They could relate a given problem to many situations they experienced and found many ways to solve the same mathematical problem. Even, they sometimes constructed the mathematical problems themselves, especially related to profit and loss, ratio and proportion which were not given in our prescribed mathematics curriculum.

Indigenous Knowledge of Mathematics Vs Western/Eurocentric Knowledge

Each community has their own practices, culture as well as own way of communication and negotiation. Thus, indigenous knowledge in general and indigenous knowledge of mathematics in particular represents the mathematical knowledge embedded in our/their daily practices. Focusing on cultural dimension of mathematical knowledge while teaching might enable students to visualize the local mathematical practices. One of the images of mathematics curriculum that I constructed after re/visiting the literature related to the indigenous knowledge of mathematics is *curriculum as a tool of collecting and presenting cultural artifacts.* Culture refers to a set of values, norms and beliefs that are common to a group of people who belong to the same ethnicity (Shrestha, 2019) in which cultural artifacts are the concretized objects prepared on the basis of those values, norms as well as beliefs. This image of mathematics curriculum might create the environment to introduce ethno-mathematics during teaching mathematics through culturally responsive pedagogy. Diverse forms of mathematical knowledge which are deeply

rooted in their relationship with the cultural cohesion have allowed many of these community to understand abstract mathematical knowledge which is likely to relate to Western practices. Moreover, arriving at this stage, by keeping the earlier images of mathematics curriculum, I am likely to align the images of *curriculum as journey* as discussed by Ibrahim (2016). Connecting mathematics curriculum in to the metaphor of *curriculum as journey* might enable students to work together with well experienced teacher around their cultural environment in which the teacher can play a role of guide throughout the journey. Teacher must accept the diversity of the classroom and need to create the environment where each child can explore his/her cultural aspects of mathematics. As some of the travelers like to explore the new experiences, some of them are interested in sightseeing, some of them can observe the nature, during travelling with the proper guidance of travel guide. Journey metaphor of mathematic curriculum motivates mathematics teachers to identify their cultural backgrounds and learning ability to guide them in the journey determined in the curriculum. Although my academic experiences say that there are less practices of introducing indigenous mathematical knowledge due to the assessment system, perception of society towards mathematics, prescribed nature of mathematics curriculum and many more. In this context, I agree with the idea of Magni (2017) who mentioned that local practice or indigenous knowledge has been subject to invasion and oppression and has often seen their knowledge eclipsed by western knowledge, imposed on them Western institutions. This is likely to happen in our context, especially in teaching and learning mathematics.

Gutierrez (2019) mentioned that indigenous ways of knowing support learner to see the worlds as comprised of actions and relationships rather than enduring qualities that are representative of discrete objects. It focuses on indigenous

knowledge in mathematics or preparation of mathematics curriculum based on indigenous knowledge or the mathematics curriculum prepared on the basis of inductive approach that promotes students to link classroom mathematics to everyday mathematics. Experiential learning, such as practical demonstrations, and oral approaches, storytelling, myth narration (instead of narrating theorem, axioms, solution of abstract problems, etc.) metaphors, or songs (Battiste, 2002 as cited in Magni, 2017) might enable to bridge the gap between indigenous mathematical knowledge and Western mathematical knowledge. Arriving at this stage, from the above discussion, I argue that as there is differentiation in mathematical practices in different culture, indigenous knowledge of mathematics might serve the essence of the images of mathematics curriculum as montage as discussed by Luitel and Taylor (2008). Montage image of mathematics curriculum offers a lot of possibilities to students for incorporating multiple knowledge systems arising from the diverse cultural and spiritual traditions. Students bring their cultural assets as ideas and practices via visuals and local material in to the classroom.

Moreover, the image of the curriculum as montage refers to the dialectic relation between agency and structure. The curriculum development procedures, the official curriculum document, and the prescribed textbooks can be considered as structure (Luitel, 2018), whereas agency is associated with actions performed by individuals and groups with a purpose to question, challenge or oppose the hegemonic normalcy of the given order (Willmott, 1999). The images of mathematics curriculum as subject matter, planned activities, learning outcomes, and discrete task and concepts as I discussed above based on ideas of Schubert (1986) which may represent the structured mathematics curricula, whereas curriculum as currere, experience and social reconstruction may represent the agency aspect of curriculum. The structure-

agency approach is a unique view of curriculum development and implementation because, as mentioned by Luitel and Taylor (2008) agency of learners cannot be enhanced and facilitated well without a structure that is self-organizing, auto-adaptive and self-reflective, and that the enhancement of this type structure, in turn, requires a strong sense of agency vested in teachers and learners. Thus, in order to develop a culturally inclusive and contextualized mathematics education, attention needs to be paid to the structure – agency dialectic; reconceptualizing curriculum as montage that promises a more inclusive and dynamic education (Luitel & Taylor, 2008).

However, in the context of Nepal subscribing to the idea of Western/Eurocentric mathematical knowledge has forced teacher and teacher educator to promote the idea of Western mathematical knowledge, symbol, rigid structure and content during the preparation of curriculum and teaching and learning process which might not be associated with any one of the cultural activities in Nepal.

More specifically, Western/Eurocentric mathematics encouraged axioms, theorems, and postulates which are not in/directly associated with our daily activities. In Nepal, more than one hundred different ethnic groups and many of them have rich mathematical practices in their day to day activities (Pant & Luitel, 2016). So subscribing to the western/Euro-centric mathematics in-front of the indigenous groups of people means disrespect and isolate our own mathematically rich cultural values and beliefs from education, especially from teaching and learning mathematics.

Further, foreign mathematics or Western mathematics promotes the binary logic of thinking. A binary logic also supports the myth that some people are good at mathematics, while others are not (Gutierrez, 2019), thereby the idea of intelligence can be a topic to discuss in school. Students' intelligence has been checked on the basis of their ability of readymade problem-solving. Western/Eurocentric

mathematics encouraged symbolic and abstract problem solving. Because of being guided by such kind of concept of mathematics, most of the mathematics teachers encourage students to solve symbolic abstract nature of the problem which is neither related to school context nor to their home environment. For instance, during a one-day workshop with around 25 middle school mathematics teachers inside the Kathmandu valley, most of the mathematics teachers constructed abstract mathematical problems based on numbers and symbol in which the trainer requested them to prepare one mathematical problem. Thus, incorporating the experience of the students as well as teachers in the mathematics curriculum enhances the 21st-century skills, as well as make them aware of local traditions and culture which is necessary to privilege the indigenous knowledge of mathematics.

The basic orientation of practical interest is towards understanding. So the practical interest-oriented curriculum focuses on teacher to make children understand through communication and collaboration instead of control. Students are highly engaged in collaboration and cooperation and construction of knowledge is based on their experience. Students and teachers both are part of curriculum planning. This interest is highly guided by social constructivism. Social constructivism views mathematics as a social construction. It draws on conventionalism, in accepting that human language, rules and agreement play a key role in establishing and justifying the truths of mathematics and is governed by the fallibilist epistemology, including the view that mathematical knowledge and concepts develop and change (Ernest, 1991). Mathematical knowledge and understanding of mathematical knowledge occur through communication, collaboration, group activities, etc. The technically oriented curriculum focuses on objective knowledge but the curriculum oriented by practical interest focuses on subjective knowledge. In this context, Grundy (1987) mentioned

that “the practical interest is a fundamental interest in understanding the environment through interaction based upon a consensual interpretation of meaning” (p. 14). Thus, mathematics curriculum oriented by practical interest focuses on the content related to the context based on the experience of students related to day to day practices.

Key Message of the Chapter

The focus of my previous chapters were traditional images of mathematics curriculum and pedagogy as well as assessment associated with those images of the mathematics curriculum. I have critically analyzed the prescriptive nature of Nepali mathematics curriculum that causes the narrative sickness in teaching mathematics. However, the highlight of this chapter was progressive images of the mathematics curriculum in which I have tried to connect the activities which have been practiced by some of the institutional schools in Nepal taking curriculum as experience.

Moreover, I am working as a teacher so I have discussed in/directly what kinds of activities enable me to change my pedagogy of mathematics as well a thought process of mathematics curriculum from traditionalism to progressivism. I did not want to claim that those activities will make affectation to all the readers like me to change that thought process but I want to claim that it enables readers to make sense about progressive images of the mathematics curriculum. While doing so, I have discussed the practice of curriculum and pedagogy of the newly opened institutional school. Similarly, I have also discussed the mathematics education conferences and the workshop I participated, which have been playing an important role to shift my practices as well as strengthen my knowledge and ideas.

CHAPTER VII

MY LEARNING AND REFLECTIONS

In this chapter, I have briefly reflected on my research journey. I have tried to represent my experiences, moments of happiness and sadness, moments of being critical towards present mathematics curriculum, pedagogy as well as assessment. Moreover, this chapter reveals how I chose and conceptualized the main issues of my research agenda; images of mathematics curriculum and pedagogical practices as well as research question for circumnavigating my inquiry process. Apart from this, I tried to highlight the moments that I realized adopting the autoethnography as a research methodology, writing as method of inquiry (Richardson & Pierre 2019), and multi-paradigmatic research design (Taylor, Taylor & Luitel, 2012). Various theories that I have used as referents throughout the research journey are discussed briefly. The main essence of this chapter is to represent how my inquiry contributed to shifting my deep-rooted traditional images of mathematics curriculum and pedagogy towards so called progressive images. Finally, I have discussed what should be my future direction in mathematics education and research.

Re-joining My Research Agenda

Embracing mathematics education as a major area of my academic journey, I have experienced and been experiencing many ups and down, joyful and regretful moments in my journey of academic life, which I have discussed throughout my research journey. To address my research issue, I have divided my academic journeys into three parts. First, my schooling; which I completed from ruler area of Nepal. Second; +2 and Bachelor which I completed under the Higher Secondary Education

Board (HSEB) and Tribhuvan University (TU) affiliated campus respectively. Gradually, I felt mathematics as abstract, difficult and mysterious when I could not relate mathematics to my daily works. Nevertheless, I continued my study taking mathematics as a major subject throughout my academic journey. One of the reasons to take mathematics as a major subject in my academic life was that I wanted to take challenge as well as there was lack of the mathematics teacher in my village, thereby aim was to be a teacher and serve the students. However, I also had an impression that taking mathematics as future career subject would help me to secure jobs in coming days. Thus, I joined KUSOED for Master's degree in 2014 A D which was my third stage of my academic journey. Experiencing different situations from these formal institutions played an important role to give birth to my research agenda for this study.

Apart from this, my informal education played an important role to understand the formal education and took an important role throughout the research. On the other hand, as a student of education (mathematics), I started teaching after completing my Bachelor and before starting Master's degree (See Chapter V). Arriving at this stage, I have had an experience of teaching mathematics in different types of institutional schools inside the Kathmandu metropolitan city and I have been getting experiences till now.

Indeed, I enjoyed teaching which has become and has been becoming a great place to learn and share. It provides an opportunity to grow oneself for the purpose of growing others. For me, school is like the university, children are like the textbook. They have been teaching many things in my life to improve myself. Furthermore, working as a teacher as well as student enabled me to integrate reflection and action called "praxis". In this context, Hua (2015) mentioned that "only when teachers

transform education into praxis can they complete responsibilities and vocation of intellectuals" (p. 55). Continuous reflection during teaching mathematics at school of my academic study enabled me to develop my lived experiences have played an important role in my career. In this context, Pinar (2009) stated that "teacher self-formation is realized by the integrity of lived experiences and academic study" (p. 11). Thus, working as a mathematics teacher as well as a student of mathematics education at university enabled me to be critical, "in order to reveal the social system roots, power roots and cultural-historical roots that result in alienation of personality and social equality" (Hua, 2015, p. 55), self-reflective as well as transformative.

However, as I come into a field of mathematics education and get engaged in teaching mathematics at school level. I face some sorts of problems as I encountered in my school life as well. My students raise question similar to the question that I and my friends raised during our schooling. The question such as: What is the real life uses of solving algebraic as well as algorithmic routine problems? What are the uses of mathematical formula? Why is mathematics necessary for us?, etc. Most of the students shared their feelings that mathematics is more difficult as compared to others subject. Mathematic is meaningless subject and many more. I have tried to address those types of queries (see chapter IV) through this study.

Arriving at this stage as an MPhil scholar and mathematics teacher researcher, I came to realize that I have grown perceiving different thoughts, beliefs, perceptions, etc. (which I call images) of mathematics curriculum and pedagogy. During my informal education unknowingly or unknowingly, I was engaged in mathematical activities with my parents, and played mathematical games with my friends and relatives. I enjoyed playing as well as engaging in mathematical rich activities. There were not any fixed activities like as someone prescribed us. We sometimes generated

our own activities and game. Rules and regulations were prepared through negotiation and communication among us. I knowingly and unknowingly learned different mathematical skills and concepts (See Chapter IV). Gradually, after entering into my formal academic journey, I started learning different subjects, Mathematics was one of them. Based on the subject mathematics, I started learning mathematical contents, started drilling and memorization by taking mathematics textbook as a major source. During my schooling I developed the images of mathematics curriculum as *textbook as curriculum, mathematics curriculum as list of contents, mathematics curriculum as tools of testing human intelligences* and so on. These images of mathematics curriculum have been in/directly affecting my academic as well as non-academic journey of life.

Gradually, my images of mathematics curriculum have been changed as my formal institutions, teachers, mathematics textbook, mathematical problem, etc. have changed. I came to realize that during my Bachelor study, I developed my images of *mathematics curriculum as product, cultural reproduction, prescription, collection of theorems, learning as recording and memorizing* and so on. Moreover, *curriculum as dollar-based document, sequence of algorithmic problems,* etc. as well as *teaching as narration* were the images of mathematics curriculum and pedagogy constructed during my initial stage of teaching in which the notion of teaching was narrating the content and mathematical problems. Most of people who are also in the field of mathematics education and training also have been guided by the deep-seated beliefs and images of mathematics curriculum and pedagogy (See chapter I) which I directly experienced and it became the main research agenda of this research. However, every image of mathematics curriculum and pedagogy that I constructed during my journey

of mathematics education has played an important role to bring this study in this stage.

Reflecting on Theoretical Referents

I have used three grand theories as referents throughout the research. Arriving at this stage what I have realized is that different theories provided me lots of space to ponder, unpack or reflect my experiences related to the understanding of mathematics curriculum, pedagogy as well as to some extent assessment. Incorporating three grand theories in this research also proved that no any educational theory is superior but every theory has its own ideology, perspective and guidelines which I have followed in this research. Moreover, Jackson and Mazzei (2017) mentioned that "thinking with theory highlights the networked functioning of thought and thus opens up the possibility of previously unthought approaches: not about what things mean but about how things work" (p. 1255). Thus, I came to realize that using various theories in this research enabled me to unfold and unpack my thoughts and beliefs of mathematics curriculum and pedagogy that represented practices and policy of mathematics education I represented. Critical question I raised in one context and situation might be connected to another situation as well. In this regard, I offered three theories as referents for meaning making process. Those theories were Knowledge Constitutive Interest (Habermas, 1972), Transformative Learning Theory (Mezirow, 1991), and Social Constructivism (Ernest, 1991).

To describe the procedures of creation of new knowledge, Habermas (1972) depicted three different knowledge constitutive interest called technical interest, practical interest and emancipatory interest. Technical interest describes that the function of the curriculum is to define and control the students' learning and emphasis is placed-on unit outlines and program structure that emphasizes the extent of control

permeating formal education (Frasar & Bosanquet, 2006). I came to realize that this perspective is more responsible to form absolutist images of mathematics curriculum such as text book as curriculum, curriculum as tools for testing human intelligences, cultural reproduction and so on. These types of images of mathematics curriculum play an important role to decontextualize and dehumanize mathematics. Moreover, pedagogy oriented by technical interest is more autocratic, transmissionist as well as promotes foundationalism and instrumentalism. In this regard, I agree with Hua (2015) who mentioned that the characteristics of technical interests include human behaviors as manipulative and controllable, teachers as in need of teaching science, mathematics or technology to effectively control students. Teacher education is the process of training teachers to master teaching science, mathematics or technology. Teacher education is an empirical-analytic science, aiming to find out objective laws of teacher education, thereby effectively controlling the process of teacher development, etc.

Arriving at this point, I came to realize that curriculum development process, pedagogy of mathematics and teacher education programs in Nepali school (both government and institutional) might promote the characteristics of technical rationality or interest. Nevertheless, the technical interest is more useful to unfold my experiences formed by curricular and pedagogical practices, discussion and interaction with mathematics teachers, teacher educators, peer groups, etc. within or outside of educational institution such as school and university.

As one of the purposes of this study was to improve my practices, the philosophy of practical interest oriented and motivated me to broaden my thinking and provided enough spaces in the field of education in general and mathematics education in particular. On the perspective of practical interest, the teachers are

practitioners, they are examiners of all curriculum, teaching and evaluation programs, and researcher of their own practices (Hua, 2015). Practically informed curricular and pedagogical practices focus on collaborative and cooperative approaches in which students are taken in the center of the learning as co-learners, co-constructers rather than agents of coding and decoding the knowledge.

Moreover, it suggested interacting with students (and teachers) to make meaning of the subject matter, thus preparing students to act on these meanings. It empowers curriculum development process to make it inclusive in which students and teachers are also the part. Teacher education is a historical-hermeneutic science, which takes teacher education back to its histories, traditions, and practices, and aims at understanding and interpreting practice (Hua, 2015) rather than preparing like technician based on technical rationality.

While I have been unpacking my experiences through varieties of ways such as narratives, dialogue, stories, poem, etc. I came to realize that me as a student from school level to higher level to some extent suppressed by the textbook oriented learning, paper pencil test which has been taking to test the intelligence of the students and making decision about his/her academic achievement. Similarly, as a teacher, practitioner and teacher researcher, I realized that we teachers are suppressed by the policy of government, in/visible sources of the society, and many more so teacher's (our) images are not only as a technician, comprador, but also a policy propagandist. In this connection, emancipatory knowledge constitutive interest empowered me to raise questions, critique towards false consequences and practices as well as 'taken for granted ideas', thereby informed me to be responsible practitioner, liberate from all sorts of destructive forces and 'one size fits all' approaches in mathematics. Moreover, emancipatory interest let me cast aside

dogmatism and false-consciousness, avoid reification and objectification and regain freedom and autonomy (Hua, 2015) that follow the transformative approach of research and teaching. It also encouraged me to break my silence, thereby explore in/visible forces embedded in mathematics educations (curriculum development, pedagogical aspect and assessment) practices through multiple genres that prepare the grounds for transformative views of mathematics.

Another theoretical referent used in this research was transformative learning theory (Mezirow, 1991). One of the aims of this study was to unpack my deep-seated beliefs embedded in mathematics education, curriculum and pedagogy, thereby shifted from conventional practices of mathematics education to modern and progressive education. Accordingly, transformative learning theory provided me the lens to view my past to shape the present, imagine future; examine and understand the causes that result in the status quo, including the causes of life success and failure; and acting to create a new 'I'. In this regard, I have unpacked my understanding of mathematics curriculum and pedagogy that I experienced and understood before joining school to my study of higher education and represented metaphorically. I came to realize that presenting and discussing the mathematics education and curriculum from the beginning of this study along with my experiences, and critical questions enabled me to develop my power of consciousness and thought, thereby helped me to transform my action in the real field.

Transformation learning theory also views memory as an inherent function of perception and cognition, an active process of recognizing again and interpreting a previous experience in a new context (Mezirow, 1991). Thus, portraying and critiquing my past experiences played an important role to shape the present with some transformations in which previously experienced knowledge is the basis to

broaden my thinking, analyzing, as well as critiquing. Further, Mezirow (1991) argued that transformative learning involves reflectively transforming the beliefs, attitudes, opinions, and emotional reactions that constitute our meaning schemas or transform our meaning perspectives. It indicates that transformative learning theory helped me to engage in critical self-reflective practices for envisioning alternative approaches of mathematics.

Finally, I used social constructivism as another theoretical referent to understand as a self in the interaction with others. Ernest (1998) mentioned that learning of mathematics requires prolonged participation in the social context of school and university mathematics, as a consequence participation in social context and practices develops and enlarges personal knowledge and competence in mathematics. Taking this statement as a reference, I communicate, collaborate, and participate in the discourses with my peers, teachers, etc. at school, university, or outside of school and university which enabled me to reflect on the present mathematics education systems and practices embedded in us. Most of the narratives and stories presented in the study were based on the communication and interaction with mathematics teachers, educators and students. I came to realize that interaction with others with or without focusing on the educational issues helped me to broaden the ideas, concepts and thinking of the issues of this research. Moreover, the methodology I subscribed in this research is autoethnography which means writing about the personal and its relationship to the cultural as mentioned by (Ellis, 2004). So, social constructivism enabled me to reflect on the relation of my experiences, knowledge and beliefs regarding the mathematics curriculum and pedagogy with others.

Reflecting on Autoethnography as Methodology

What I experienced during this work is that one of the major tasks for researcher is to identify the appropriate research methodology to conduct the research. Researcher needs to have knowledge about the various research methods so that the researcher subscribes to the appropriate one. Addressing the research issues in appropriate manner, fulfilling the research purpose and addressing the research question(s), collecting and analyzing the data/text meaningfully, maintaining ethical behaviors, etc. depend on the methodological aspect of the research. Based on the purpose and issues as well as interest, I have chosen autoethnography as research methodology and writing as a method of inquiry. Among the varieties of qualitative and quantitative research methodology, I first encountered autoethnography when I was in the third semester of my Master's degree at Kathmandu University school of Education (KUSOED), Kathmandu Nepal. I superficially developed the knowledge of different research methodologies such as ethnography, autoethnography, narrative, survey, phenomenology, etc., I came up with the action research report as my Master's research project based on interpretative approach. Later, during the class of research methodology of my MPhil at KUSOED, I got an opportunity to broaden my ideas and knowledge of autoethnography as research methodology which played an important role to complete this study.

Ellis (2004) mentioned that "autoethnography refers to writing about the personal and its relationship to cultural. It is an autobiographical genre of writing and research that displays multiple layers of consciousness" (p. 37). Human consciousness is important and it is the basis of thought, feelings, and actions, common to all humanity (Kumar, 2013). Thus, throughout my research journey, I have unpacked my experiences as a mathematics student, mathematics teacher, facilitator, etc. taking

mathematics curriculum and pedagogy in the center of the research. My autoethnographic text throughout the research appeared in the variety of forms, such as short stories, poetry, journals, etc. They really showcase the features as mentioned by Ellis (2004) such as concrete action, dialogue, emotion, embodiment, spirituality and self-consciousness.

As I have located myself through others' eyes and heart, considered others' alternative points of views and interpretations, tried to feel others' plights, autoethnography as mentioned by Adams, Jones and Ellis (2016) has contributed to making my relational life deeper and more satisfying. I examined my experiences of working as a student, teacher, teacher educator, etc. in and chronic way in the context of emerging and ever-changing relationships and came in the world of others as much as I to understand the self. Moreover, autoethnography enabled me to improve myself in my professional career and helped me to develop my personality wisely. In this context, autoethnography opened my eyes to see who I am, opened my mind to realize who I am, opened my soul to understand what I am doing and what I need to do (Belbase, Luitel & Taylor, 2008).

As an autoethnographer, I foregrounded the power of stories to describe and critique culture, thereby myself as well as readers can come to the process of sense making, and the reflexivity. Reflexivity includes both acknowledging and critiquing our place and privilege in society and using stories I (we) share to break long-held silence of power, relationships, cultural taboos, and forgotten and/or suppressed experiences (Adams, Jones, & Eills, 2015). Thus, unpacking my professional experiences and looking back to my experiences enabled me and might enable readers to critique the social injustice, inequalities, thereby trying to emancipate from the dogmatism. During reflecting and unpacking my professional experiences of working

as mathematics teachers, I represented helpful and unhelpful both images of mathematics curriculum and associated pedagogies. During reflecting and critiquing upon unhelpful images of mathematics curriculum such as curriculum as textbook, cultural reproduction, product, etc. enabled me to look for alternative approaches of teaching mathematics and curriculum development, and raised questions to the policy makers and government. On the other hand, reflecting upon helpful images of mathematics curriculum such as curriculum as collection of as art, experiences, etc. motivate me to integrate different disciplines of knowledge during teaching mathematics through critical pedagogy, STEAM pedagogy, and so on.

Moreover, I came to realize that autoethnography became an important tool to break my silence and quietness. Jones, Adams, and Ellis (2016) mentioned that traditional research often adheres to hegemonically masculine traits, focuses on objectivity, control and predictability. Therefore, humanity, subjectivity, emotions and feelings become the shadow during research, thereby researcher is often guided by hegemonic rules and dogmatic beliefs and practices. However, autoethnography enabled me to break my silence by privileging subjectivity, uncertainty, emotional voices, personal voices, etc., thereby developing my confidence level, being able to add my view and opinion regarding inclusive and alternative practices of teaching mathematics, curriculum development along with the multi-paradigmatic design space.

Firstly, paradigm of interpretivism enabled me to explore my lived experiences that helped me to know who I am, what my position is, what I am doing, etc. During the exploration of my lived experiences, I examined my hidden stories and narratives regarding my mathematics education, curriculum and pedagogical practices that provided the detailed information about my professional journey.

Second, paradigm of criticalism helped me to nurture critical consciousness that empowered me to raise questions such as: who am I, why I am doing some things, whose interest is being served? These types of questions led me to explore the power relation, injustices, inequality, etc. behind the existing mathematics education practices. Moreover, criticalism also enabled me to prepare grounds for envisioning the alternative vision of mathematics education. Thirdly, paradigm of postmodernism enabled me to focus on the importance of self-reflections, envisioning, and lived experiences through personalized writing. On the other hand, this paradigm employs art-based research to engage, thereby employs multiple genres such as narrative, dialectical, metaphorical, etc. for exploring my experiences as a student, teacher, teacher educator, a member of society, etc.

Responding to Research Questions

I experienced that one of the major tasks of academic researcher is to prepare the research question(s). Initially, I started writing on the basis of single research question. With the development of the different chapters, I divided that single research questions into four different questions in which, each research question addressed one chapter. Nevertheless, I tried to respond to each research question in different chapters. During development and analysis of the chapter, those research questions got modified many times with multiple sitting with my supervisor. However, finally I came up with the following four research questions:

1. How did I develop different curriculum images of mathematics by interacting with daily life entities in early years of schooling?
2. How did I conceptualize pedagogical approach in mathematics from the perspectives of different curriculum images as a university student?

3. How did I construct different disempowering images of mathematics curriculum and promote one-way narration pedagogy?
4. How have I been transforming towards valuing the progressive images of mathematics curriculum from conventional curriculum images?

Arriving at this stage, I came to realize that I was involved in different mathematical activities, communication, dialogue, etc. (see chapter IV) during my early childhood. Knowingly or unknowingly, I learned different mathematical concepts through mathematically rich game and daily activities. At the same time, activities as well as rituals organized in the society enabled me to build the concepts of geometry, number sense, problems solving skills, and many more. Moreover, playing mathematical rich game with friends, brother and sister as well as participating in the shopping activities with my parents enabled me to visualize and conceptualize the informal mathematics which might be very helpful to understand abstract concepts of mathematics taught in school. Thus, *mathematics curriculum as local body of knowledge, mathematics curriculum as collection of games, mathematics curriculum as tools for effective communication and socializing,* etc., were images of mathematics curriculum which were constructed before joining school. Taking those contexts as a source of inquiry, I have responded to the first research question: How did I develop different curriculum images of mathematics by interacting with daily life entities in early years of schooling? in chapter IV. Moreover, this research question also covered my critical thought and analysis of my early years of schooling in which I have constructed the images of mathematics curriculum: *curriculum as textbook, curriculum as tools for testing human intelligences, curriculum as a list of contents, etc.* Indeed, my experiences of learning mathematics at my early days of school followed by the official mathematics

curriculum was totally different than the mathematical activities that I participated before starting school. The gap between school mathematics followed by official and structured mathematics curriculum and the mathematics out of the classroom and school that I experienced really empowered me to construct different images of mathematics curriculum during my early days of schooling.

Further, I have responded to my second research question: how did I conceptualize pedagogical approach in mathematics from the perspectives of different curriculum images as a university student? in chapter V. Initially, I have expressed my excitement of joining university campus as a Bachelor level student of mathematics education. As a student of mathematics education, I had lots of hopes and expectations from the campus. However, throughout my study of mathematics education at Bachelor level at campus, I was suffering from the process of coding and decoding of lots of mathematical stuffs such as theorem, postulate, formula, definition, and many more. As per my understanding, coding is method of transmitting information in the form of code, ideas, rules as well as techniques and decoding is the process of understanding the transmitted codes, ideas, rules and techniques by the receiver. In this regard, I was a receiver of the transmitted stuffs, and the lecturer was a transmitter. Indeed, the coding and decoding ways of learning mathematics demotivated the students to learn mathematics in higher level (and lower level), thereby affects success rate as well as participation in learning mathematics. Arriving at this stage, I agree with Macintyre and Hamilton (2010) as they stated that one of the challenges for policy-maker, educationalist, teacher as well as school today is to increase participation levels and success rate within the study of mathematics.

Further, because of lack of selecting the appropriate pedagogy, content as well as decontextualized nature of mathematics curriculum, today's teaching and learning

mathematics has promoted instrumentalism which I have also experienced during my learning mathematics. As per my understanding, instrumentalism provides instrumental understanding rather than relational understanding. It aims to follow rules, steps, procedure as well as formula which already exist. In this scenario I agree with Luitel (2013) as he mentioned that we implemented (have been implementing) mathematics curriculum in accordance with the nature of mathematics as instrumental in reproducing the Western Modern Worldview, transporting from the British–Indian colonial era, which reigned in neighboring India for many years until the middle of the 20th Century. Thus, I have expressed the pedagogical context that I experienced during my Bachelor level study through multiple genres such as poem, story, etc. as well as constructed images of mathematics curriculum such as *curriculum as product, canvas of curriculum as cultural reproduction, curriculum as prescription,* etc.

As I started my teaching career, the third research question was developed to assess my beliefs towards mathematics curriculum. I represented my beliefs towards mathematics curriculum metaphorically with associated pedagogy. However, the main essence of this chapter is to discuss how I was a Universalist mathematics teacher, thereby my role was to promote universalism through one-way narration approach of pedagogy. So initially, I began the chapter with the reflection of the society towards higher education. As I started my teaching career, I joined the university for my Master's degree. After that, I have unfolded my first experiences of teaching mathematics as a universalist teacher in which my role was to teach mathematics as a universal fact knowledge. Similarly, universalism appears to be associated with expansionist discourses and is taken to explain the view that the mathematics curriculum is developed in the same way everywhere notwithstanding of contextual variations (Rizvi, 2006). Furthermore, I have discussed my experiences of learning

which was dominant in my initial stage of teaching and discussed under the topic: *curriculum as cultural reproduction.* In this regard, I have discussed focusing on what I learned during my schooling was important rather than what I am going to teach now or what I was in the past is dominant rather than who I am at present. Thus, I as a mathematics teacher act as a more knowledgeable person and think that students have empty mind and they do not have any pre knowledge and experiences of new knowledge.

Moreover, I have represented conversation between me (as teacher and a researcher) and one of the mathematics teacher educators regarding the mathematics curriculum and teaching mathematics. I realized how people directly and indirectly represented their view or thought of mathematics curriculum as a foreign document which I have discussed under the constructed images of *mathematics curriculum as foreign mathematics: teaching for promoting foreign mathematics*. During discussion, I have constructed other images of mathematics curriculum such as *curriculum as dollar-based document* in which mathematical money problem has been created including foreign currency that really plays an important role to promote universalism rather than contextualization. On the other hand, I had bitter -experiences of selecting mathematics textbook for students focusing on the algorithmic problems. The books which had more algorithmic problems were selected. On that scenario, the role of teacher (my) was to narrate the algorithmic problems as well as solution given in the example instead of construction of real-life mathematical problem. Thus, one of the constructed images of mathematics curriculum was: *curriculum as sequence of algorithmic problems: teaching as one-narration of the problems and solution.* Moreover, *curriculum as textbook* was another constructed image of mathematics curriculum which I constructed on the basis of interaction with a parent. I came to

realize that most of the parents do not have the knowledge of mathematics curriculum but know more about the mathematics textbook. They wanted that teacher to teach everything from the textbook, force students to memorize and practice more routine problems from the textbook in which the role of teacher is to narrate the process and steps of problems solving.

At the end of the chapter, I discussed how those images of mathematics curriculum enabled me to approach the one-way narration pedagogy in the classroom. I came to know that one-way narration pedagogy enables teachers to give lecture to the students about the process and steps of solving mathematical routine problems in which students become passive listeners and copy narrated process and steps as well as examples of problems solving.

Finally, I developed chapter VII to address my final research question: How have I been transforming towards valuing the progressive images of mathematics curriculum from conventional curriculum images? This chapter also reveals that integrated approach of mathematics curriculum rather than disciplinary approach is more powerful to enhance students' mathematical understanding and thinking through the various pedagogical approaches. Among them, I have focused on STEAM pedagogy in teaching mathematics. STEAM pedagogy enables teacher to balance the knowledge and skills between science, technology, engineering, art and mathematics while dealing with children in mathematics classroom. Indeed, connection of various disciplinary knowledge during teaching mathematics enables students to relate mathematic into real-life activities, thereby get motivation to learn mathematics.

Working one year at experiential learning-based school became a big platform for me to apply my progressive thoughts and beliefs towards mathematics education enhanced through my Master's degree and MPhil from KUSOED. I also got

motivated from the school management to integrate mathematics in to other subjects such as science and social studies. Later on, I started collaboration with the subject teachers those who were teaching computer, arts, science, etc. while preparing lesson plan to find the mathematics knowledge embedded in those subject areas and tried to introduce it inside the mathematics classroom. Wherever I worked after 2016 AD, fortunately, I found and have been at technologically rich classroom so that it is not difficult to integrate technology in mathematics classroom.

Similarly, participating in the national and international conferences related to mathematics/education enabled me to broaden the pedagogical ideas and skills of mathematics which I have been trying to implement inside the classroom. Apart from this, being an observer, participant as well as evaluator of different mathematical expositions organized by different schools inside the Kathmandu valley motivated me to look mathematics curriculum from different lenses. For instance, after getting the experiences of those opportunities as well as experiences of applying those gained experiences, I developed the various empowering and motivated images of mathematics curriculum such as mathematics *curriculum as collection of art, curriculum as experiences, curriculum as dynamic text, curriculum as collection of interdisciplinary content knowledge, curriculum as collection of games, etc*.

However, whatever the policy but the practice of mathematics in our context is still traditional. From my observation, most of the people in our society still hold beliefs that mathematics is an isolated and lifeless subject. Because of lack of strong education policy as well as lack of student friendly curriculum, those beliefs of society towards mathematics curriculum and mathematics really make negative impact on the school performance. Because of this type of traditional thinking and practices about mathematics education, mathematics teachers are judged by school

administrators and parents by the grades and score that the students secure in the report card.

Me at Present

One of the purposes of autoethnographic research was to share the researcher's professional and academic experiences, thought, personality, etc. in which I started to unpack my experiences in a critical and reflective way from the very beginning of the chapter. I started this research journey aiming at unpacking of my understanding of mathematics curriculum and associated pedagogies and representing in metaphorical ways. Thus, during this research, my-self was a critical reflective practitioner. The major themes that I deeply engaged in the research were mathematics curriculum and pedagogy. On the other hand, assessment practices were discussed side by side.

Thus, I made more vivid understanding in those areas of mathematics curriculum and pedagogy. I got ample opportunities to read papers, books and critically reflect on them in relation to my areas. More specifically, I explored my images of mathematics curriculum and pedagogy. Using autoethnography as a methodology and writing as a method of inquiry enabled me to uncover myself with the relation of others' experiences through critical reflective way. This critical inquiry helped me to understand who I am, what I am doing and why I am doing in the field of academia in general and in the field of mathematics education in particular.

As a practitioner teacher researcher, I might be successful to open and raise the issues, problems, difficulties, which have occurred and been occurring in the field of mathematics education. Discussing those issues and difficulties enabled me to make others as well as myself aware. Thus, arriving at this stage, I came to realize that myself as one of the responsible persons to make others aware of those who are

working as a teacher, researcher and student by showing the pictures of social practices which might be shaped by hegemony and dogmatism. Further, with the stopping of my writing in this research, I might able to show lots of issues to the readers related to the mathematics education that might be the topic of another future research. Nevertheless, I came to realize that I successfully investigated on the issues that I raised and responded to the research questions that I prepared by taking subscribed theory as referents in the center of the research, thereby myself as becoming a transformative critical teacher researcher.

Basically, during portrayal of my narratives and stories, I was guided by different three approaches (informative, reformative and transformative) of research. Informative approach enabled me to portray my narratives as a simple actor of the environment. Reformative approach enabled me to view my experience to some extent different from the existing situation. Transformative approach empowered me to offer critical dimension of mathematics for bringing the change in practices. I acknowledge all three perspectives in the field of mathematics that helped me to re/shape my personal as well as professional life for becoming transformative practitioner teacher and researcher.

My Vision of Mathematics Curriculum

Taking my experiential permit, Schubert's (1986) as well as Luitel's and Tylor's (2008) curriculum metaphors as references, I constructed different curriculum images throughout the research journey and analyzed critically with their pedagogical implications. I have problematized the research or gave birth to the research issue with one conventional image of mathematics curriculum (*curriculum as V-SURF*, *stable document, etc.)* which I got experienced from a teacher professional development program. I have reviewed the different curriculum images such as

curriculum as content, curriculum as cultural reproduction, etc. based on Schubert (1986) and Luitel (2008). My chapter IV, V and VI gave the conventional images of mathematics curriculum, in which I have constructed images based on my curricular and pedagogical experiences that I experienced from my schooling to higher study as well during teaching mathematics at different institutional schools. Moreover, as I got different opportunities to work with different professionals in the field of education in general and mathematics education in particular, I constructed other images of mathematics which are more helpful as well progressive in nature which have taken place in chapter VII of this research.

One of the approaches of transformative research is to engage in their practices and experiences that might help them to transform from one paradigm to another. In this context, Luitel and Taylor (2019) pointed that transformative research approach engages educational practitioners in research as a transformative learning experiences for the purpose of transforming their professional practices, and thus the

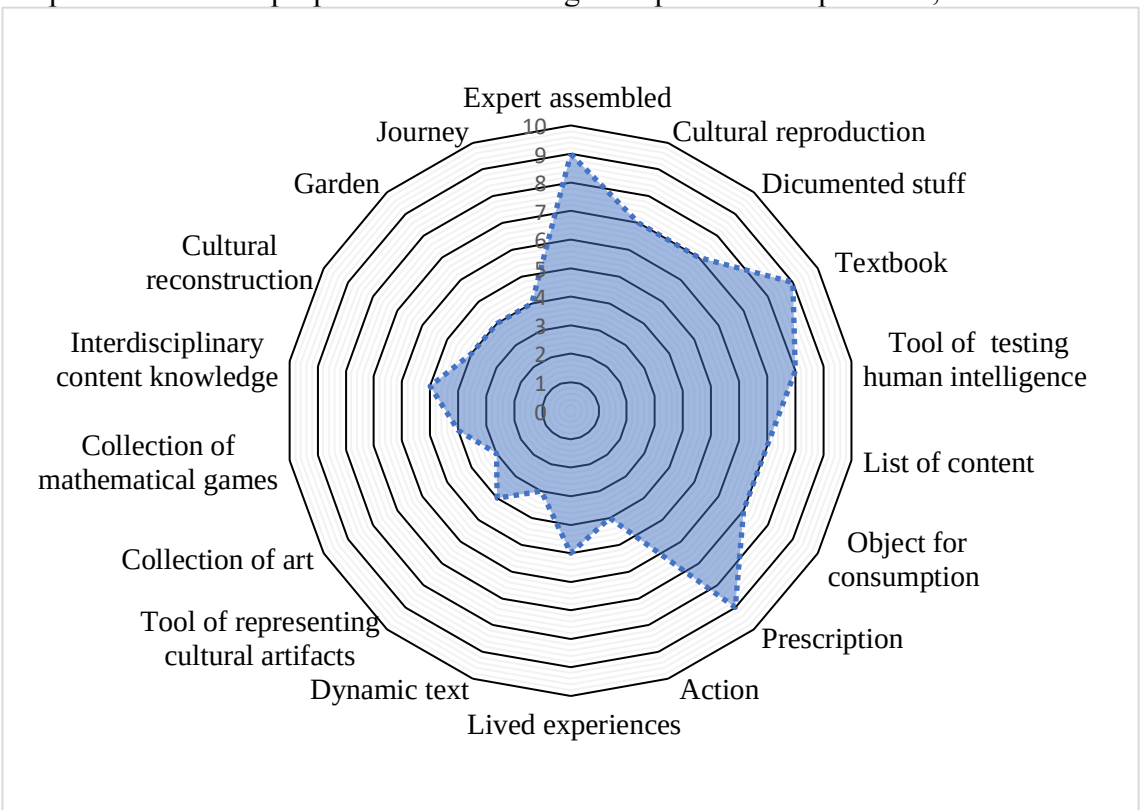

Figure 19: My actual qualitative map of mathematics curricula of Nepal

lives for future generation. I came to realize that transformation of researcher's professional practices may happen when s/he is engaged in his or her academic as well as professional practices or experience, thereby envisages for future possibilities. In addition, as a transformative researcher, one of my roles is to reflect and critically analyze my lived experience, thereby accept the paradigm shift in the field of education. In this context, Taylor and Medina (2019) pointed that research as transformative learning impels us to encounter the richness of lived experiences at our fingerprints, and to invite others to open their hearts and minds to the infinite possibilities of our rapidly developing worlds.

Arriving at this stage, I have constructed the qualitative map (see figure 19) of my actual understanding of present mathematics curriculum by combing the various curriculum images that I explored and discussed throughout this research journey. The pictorial representation of my actual map of present mathematics curriculum is aligned with the conventional images of mathematics curriculum. Aligned with the

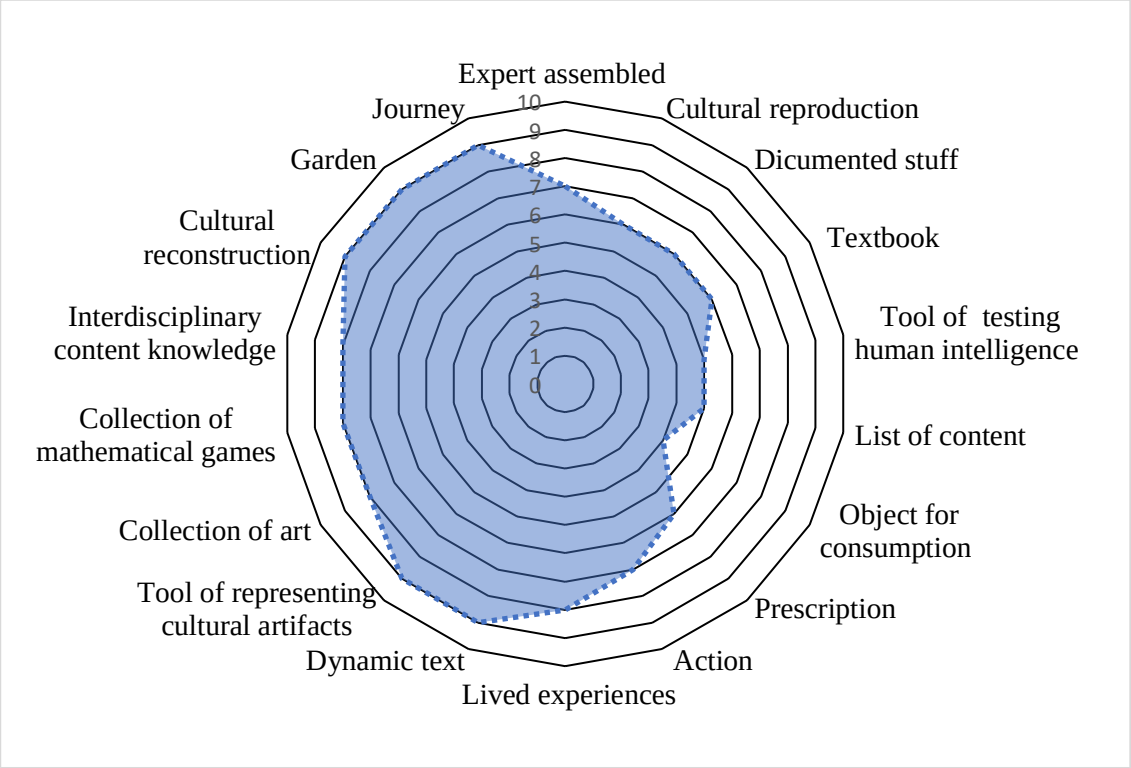

Figure 20: My Preferred Qualitative map of Mathematics Curricula of Nepal

conventional images of mathematics curriculum it depicts that there is lots of space to revise the Nepali mathematics curriculum.

On the other hand, I have also unpacked my perspectives on alternative mathematics curriculum images which are likely to help to promote the cultural contextualization of mathematics teaching and learning activities. Alternative images of mathematics curriculum, which I would prefer for future mathematics curriculum development, and were constructed on the basis of my professional as well as academic experiences. In this context, I constructed the qualitative map (see figure 20) of my preferred images of mathematics curriculum that might cover the needs of 21st century's learners' specific needs and interest as well as address the traditional territory or conventional approach or developing of mathematics curriculum (i.e. subject centered, hegemonic, etc.) in more balanced and inclusive way.

Comparing my experientially constructed actual images of mathematics curriculum with my preferred images of mathematics curriculum demonstrates visible differences between a conventional curriculum perspective and reform-oriented inclusive curriculum perspective, in which the pictorial representation of my actual images cover the traditional as well as hegemonic territory of curriculum development, whereas my preferred mathematics curriculum images motivate and promote to develop the mathematics curriculum in a balanced manner maintaining inclusiveness.

My Further Direction

It is easy to set goals but really difficult to accomplish in the limited time period. Passion, dedication and hard work matter a lot to reach the goal set by any individual. Moreover, supportive, collaborative and co-operative environment also matters a lot to reach the goal. At the same time, arriving at this stage means my one

of the goals is being nearer to accomplish which I set with the completion of my Master's degree. I mentioned in my Master's research project about what I was doing then.

As a mathematics teacher researcher, I am always looking for a shift from the traditional way of teaching and learning mathematics to a modern and progressive way. In that case, curriculum and pedagogy and teacher education program matter a lot. In the context of Nepal, prescribed and informative curriculum hinder teacher from incorporating transformative pedagogy for sustainable future of learners. Universalist as well as foundationalist mathematics followed by disciplinary approach has been dominant in our practices. Students and teachers both are experiencing assessment of learning rather than assessment for and assessment as learning. However, throughout the research journey, I discussed the issues related to mathematics curriculum and pedagogy and represented it metaphorically. While doing so, I came to the conclusion that the images of *mathematics curriculum as experiences, curriculum as collection of an art, curriculum as interactive process of teaching and learning*, etc. are images of mathematics curriculum that promote transformative STEAM curriculum and pedagogy and enhance the 21st century skills such as critical thinking, collaboration, creativity, etc. of students. Moreover, these images also break the rule of disciplinary approach of teaching and learning so that they promote integrated curriculum and interdisciplinary approach of learning.

Nevertheless, as a mathematics teacher researcher, my role is to make mathematics easily accessible to everyone without any mathematical anxiety as well as make them locally and globally competent which promotes inclusive and contextualized mathematics curriculum. In this regard, transformative STEAM curriculum and pedagogy will be the best fit. So, as a change agent, my passion to

transform the mathematics education is not to stop with this study, rather I will continue to work on transforming the mathematics education practices advocating transformative STEAM curriculum and pedagogy. Moreover, if I got an opportunity to continue my further study, then STEAM would be my framework that provides an avenue for how different subjects relate in real life.

REFERENCES

Adams, T. E., Jones, S. H, & Ellis, C. (2016). Coming to know autoethnography as more than method. In Adams, T. E., Holman Jones, S., & Ellis, C. (Eds.), *Handbook of Autoethnography.* New York, NY: Routledge.

Adams, T. E., Jones, S. H, & Ellis, C. (2015). *Autoethnography: Understanding Qualitative Research.* New York, NY: Oxford University Press.

Aslan Tutak, F., Bondy, E., & Adams, T. L. (2011). Critical pedagogy for critical mathematics education. *International Journal of Mathematical Education in Science and Technology*, *42*(1), 65-74.

Baptist, K. W. (2002). The garden as metaphor for curriculum. *Teacher Education Quarterly, 29*(4), 19-37.

Barrow, R. (2015). *Giving Teaching back to Teachers: A Critical Introduction to Curriculum Theory*. Routledge.

Belbase, S., Luitel, B., & Taylor, P. (2008). Autoethnography: A method of research and teaching for transformative education. *Journal of Education and Research*, *1*(1), 86-95.

Bochner, A. (2016). Putting meanings into motion. In Adams, T. E., Holman Jones, S., & Ellis, C. (Eds.), *Handbook of Autoethnography.* New York, NY: Routledge.

Bolognesi, M. (2018). How Do Words vs. Images Construct and Represent Metaphor? In *TriCoLore (C3GI/ISD/SCORE)*.

Brookfield, S. (1998). Critically reflective practice. *Journal of Continuing Education in the Health Professions, 18*(4), 197-205.

Brookfield, S.D. (2005). *The Power of Critical Theory for Adult Learning and Teaching*. Maidenhead: Open University Press.

Bryman, A. (2012). *Social Research Methods* (4th ed.). Oxford University Press.

CDC Nepal. (2018). *Basic level (grade 1 -3) curriculum*. Sanothimi Bhaktapur, Nepal: Authors.

Chase, S. E. (2018). Narrative inquiry: Toward theoretical and methodological maturity. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (5th ed., pp. 544–560). Thousand Oaks, CA: Sage.

Cobb, P., & Steffe, L. P. (2011). The constructivist researcher as teacher and model builder. In *A journey in mathematics education research*. Dordrecht: Springer.

Crasewell, J. W. (2012). *Educational Research Planning, Conducting and Evaluating Quantitative and Qualitative Research* (4th ed.). Boston, MA: Pearson

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

Davis, K., Christodoulou, J. A., Seider, S., & Gardner, H. (2011). In Cambridge Handbook of Intelligence (eds Sternberg RJ & Kaufman SB) 485–503.

Denshire, S. (2013). Autoethnography. *Sociopedia. Isa*, doi. 10.1177/205684601351.

Ellis, A. K. (2013). *Exemplars of Curriculum Theory*. New York, NY: Routledge.

Ellis, C. (2004). *The Ethnographic I: A Methodological Novel about Autoethnography*. Rowman Altamira.

Ellis, C. (2017). Manifesting compassionate autoethnographic research. *International Review of Qualitative Research, 10*(1), 54-61.

Emas, R. (2015). The concept of sustainable development: definition and defining principles. *Brief for GSDR, 2015*.

Ernest, P. (1991). *The Philosophy of Mathematics Education*. London: Flamer press.

Ernest, P. (1998). *Social Constructivism as a Philosophy of Mathematics*. Suny Press.

Feikes, D., Schwingendorf, K, & Gregg, J. (2014). *Children's Mathematical Learning*. USA: Pearson Education, Inc.

Fraser, S. P., & Bosanquet, A. M. (2006). The curriculum? That's just a unit outline, isn't it? *Studies in Higher Education, 31*(03), 269-284. doi:10.1080/03075070600680521

Freire, P. (1993). *Pedagogy of the Oppressed*. New York, NY: Continuum.

Furman, R. (2006). Poetic forms and structures in qualitative health research. *Qualitative Health Research, 16*(4), 560-566.

Gross, K., & Gross, S. (2016). Transformation: Constructivism, design thinking, and elementary STEAM. *Art Education, 69*(6), 36-43.

Grundy, S. (1987). *Curriculum: Product or Praxis?* London: Falmer Press

Gutierrez, R. (2019). Mathematx: towards a way of being. *Proceeding of a Tenth International Conference of Mathematics Education and Society*. Hyderabad, India, ISSN: 2077-9933.

Habermas, J. (1972). *Knowledge and Human Interests*. London: Heinemann

Hua, Z. (2015). On Teacher Development. In Hua. Z & Pinar, W. F. (Eds.) *Autobiography and Teacher Development in China: Subjectivity and Culture in Curriculum Reform.* New York, NY: Macmillan.

Ibrahim, A. M. (2016). Curriculum metaphors. *The Eurasia Proceedings of Educational & Social Sciences, 4,* 385-390.

Ifeyinwa, E. M. (2014). Problem of foundationalism as a theory of epistemic justification. *IOSR Journal of Humanities and Social Sciences (IOSR-JHSS), 19*(8), 102 – 105.

Jackson, A. Y., & Mazzei, L. A. (2018). Thinking with theory: A new analytic for qualitative inquiry. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (5th ed.). Thousand Oaks, CA: Sage.

Jafari, A., & Kaufman, C. (2006). *Handbook of Research on ePortfolios*. Hershey, PA: Idea Group Reference.

Jha, K., Adhikari, P. R., & Pant, S. R. (2006). A history of mathematical sciences in Nepal. *Kathmandu University Journal of Science, Engineering, and Technology, 2*(1).

Kelly, A. V. (2009). *The Curriculum: Theory and Practice*. Sage.

Kumar, A. (2013). *Curriculum as Meditative Inquiry*. Springer.

Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago, IL: The University Chicago Press.

Lamichhane, B. J. (2019). *Delving into my images of mathematics curriculum, pedagogy and assessment: An Auto/ethnographic inquiry* (Unpublished dissertation for Masters of Philosophy in Mathematics Education). Kathmandu University, Nepal.

Lerman, S. (1990). Alternative perspectives of the nature of mathematics and their influence on the teaching of mathematics. *British Educational Research Journal, 16*(1), 53-61.

Liao, C. (2016). From interdisciplinary to transdisciplinary: An arts-integrated approach to STEAM education. *Art Education, 69*(6), 44-49.

Luitel, B. C. & Taylor, P. C. (2005). Overcoming culturally dislocated curricula in a transitional society: An autoethnographic journey towards pragmatic wisdom. *Presented at the annual meeting of the American Educational Research Association (AERA).*

Luitel, B. C. (2003). *Narrative explorations of Nepali mathematics curriculum landscapes: An epic journey* (Unpublished Master's Project). Curtin University of Technology, Perth.

Luitel, B. C. (2009). *Cultural, worldview and transformative philosophy of mathematics education in Nepal: A cultural-philosophical inquiry* (Unpublished Doctoral thesis). Science and Mathematics Education Centre, Curtin University, Perth, Australia.

Luitel, B. C. (2018). A mindful inquiry towards transformative curriculum vision for inclusive mathematics education. *Learning: Research and Practice*, *4*(1), 78-90.

Luitel, B. C. (2019). Journeying towards a Multi-Paradigmatic Transformative Research Program: An East-West Symbiosis. In *Research as Transformative Learning for Sustainable Futures* (pp. 19-37). Brill Sense.

Luitel, B. C., & Taylor, P. C. (2007). The shanai, the pseudosphere and other imaginings: Envisioning culturally contextualized mathematics education. *Cultural Studies of Science Education, 2*(3), 621-655. Springer.

Luitel, B. C., & Taylor, P. C. (2008). *Globalization, ecological consciousness and curriculum as montage:* A vision for culturally contextualized mathematics education. In: 16th Annual Conference of the Southern African Association for Mathematics, Science and Technology (SAARMATE) 2008, 14 – 18 January 2008, Maseru, Lesotho.

Luitel, B. C., & Taylor, P. C. (2019). Introduction: Research as Transformative Learning for Sustainable Futures. In *Research as Transformative Learning for Sustainable Futures* (pp. 1-16). Brill Sense.

Luitel, B.C. (2013). Mathematics as an im/pure knowledge system: Symbiosis (w)holism and synergy in mathematics education. *International Journal of Science and Mathematics Education 10* (6). Taiwan: Springer ISSN 1571-0068.doi: http://dx.doi.org/10.1007/s10763-012-9366

Luitel, L. (2019). Nature of mathematics and pedagogical practice. *Proceeding of a Tenth International Conference of Mathematics Education and Society.* Hyderabad, India, ISSN: 2077-9933.

Luitel, L., & Pant, B.P. (2019). Images of mathematics curriculum held by school mathematics teachers: Mapping the road for transformative pedagogies. In Rahmawati, Y., & Taylor, P. C. (Eds.), *Empowering Science and Mathematics for Global Competitiveness: Proceedings of the Science and Mathematics International Conference (SMIC 2018), November 2-4, 2018, Jakarta, Indonesia*. CRC Press.

Macintyre, T., & Hamilton, S. (2010). Mathematics learners and mathematics textbooks: a question of identity? Whose curriculum? Whose mathematics? *The Curriculum Journal*, *21*(1), 3-23.

Magni, G. (2017). Indigenous knowledge and implications for the sustainable development agenda. *European Journal of Education, 52*(4), 437-447.

Mariana, N. (2017). *Transforming mathematics problems in Indonesian primary schools by embedding Islamic and Indonesian context* (Unpublished Doctoral thesis). School of Education, Murdoch University, Australia.

Marsh, C. J., & Stafford, K. (1984). *Curriculum: Australian Practices and Issues*. McGraw-Hill.

McNiff, J., & Whitehead, J. (2006). *All you need to know about Action Research*. Sage Publication, New Delhi.

Mellin-Olsen, S. (1981). Instrumentalism as an educational concept. *Educational Studies in Mathematics*, *12*(3), 351-367.

Mezirow, J. (1991). *Transformative Dimensions of Adult Learning*. California, CA: Jossey Bass.

Miller, R. L & Brewer, J. (2003). *The A-Z of Social Research. A Dictonary of Key Social Science Research Concepts*. Sage.

Mirza, M. (2012). *The politics of culture: The case of universalism.* Palgrave Macmillan.

Neagley, R. L., & Evans, N. D. (1967). *Handbook for Effective Curriculum Development*. Prentice Hall.

Newell, T. (2014). *Five Paradigms for Education: Foundational views and key Issues.* Palgrave Macmillan

North, J. G. (2014). Culturally relevant pedagogy: Secondary mathematics in an urban classroom. *Honors Program Theses*. 97. Retrieved from https://scholarworks.uni.edu/hpt/97

Null, W. (2011). *Curriculum: From Theory to Practice.* Rowman & Littlefield.

Oers, V. B. (2002). Educational forms of initiation in mathematical culture. In *Learning Discourse* (pp. 59-85). Springer, Dordrecht.

Pant, B. (2015). *Pondering on my beliefs and practices on mathematics, pedagogy, curriculum and assessment* (An unpublished MPhil dissertation). Kathmandu University, Dhulikhel Nepal.

Pant, B., & Luitel, B. C. (2016, July). Beliefs about the nature of mathematics and its pedagogical influences. In *Presented on 13th International Conference on Mathematical Education* (pp. 24-31). Humburg.

Panthi, R. K., & Belbase, S. Teaching and Learning Issues in Mathematics in the Context of Nepal. *European Journal of Educational & Social Sciences, 2*(1), 1-27.

Parakyla, A., & Ruusuvuori, J. (2018). Analyzing talk and text. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (5th ed.). Thousand Oaks, CA: Sage.

Parzysz, B., Kadunz, G., Robotti., & Rogers, L. (2007). The role of images and metaphors in the learning and understanding mathematics (including embodied cognition). In *Proceedings of the 5*th *Conference of the European Society for Research in Mathematics Education*.

Pinar, W. F. (2004). *What is curriculum theory?* Lawrence Erlbaum Associates.

Pinar, W. F. (2009). The Worldliness of a Cosmopolitan Education. New York, NY: Routledge.

Presmeg, N. (2014). A dance of instruction with construction in mathematics education. In *Early mathematics learning* (pp. 9-17). New York, NY: Springer.

Pushor, D. (2013). Bringing into being a curriculum of parents. In Pushor (Ed) *Portals of promise: Transforming Beliefs and Practices Through a Curriculum of Parents*. Springer Science & Business Media.

Quiquan, Z. (2015). Teachers Research and Learning: New Patterns and Challenging. In Hua. Z & Pinar, W. F. (Eds.) *Autobiography and Teacher Development in China: Subjectivity and Culture in Curriculum Reform.* New York, NY: Macmillan.

Qutoshi, S. D. (2016). *Creating living-educational theory: A journey towards transformative Teacher education in Pakistan* (Unpublished Doctoral dissertation). Kathmandu University, Dhulikhel.

Radziwill, N. M., Benton, M. C., & Moellers, C. (2015). From STEM to STEAM: Reframing what it means to learn. *The STEAM Journal*, *2*(1), 3.

Rahmawati, Y. (2019). Returning Home: Key Challenges Facing a Transformative Educator. In *Research as Transformative Learning for Sustainable Futures* (pp. 265-278). Brill Sense.

Richardson, L. (2018). Writing: A method of inquiry. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (5th ed., pp. 1410-1422). Thousand Oaks, CA: Sage.

Richardson, L., & Pierre, E. A. (2018). Writing: A method of inquiry. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (5th ed.). Thousand Oaks, CA: Sage.

Rivera, F. (2011). *Toward a visually-oriented school mathematics curriculum: Research, theory, practice, and issues* (Vol. 49). Springer Science & Business Media.

Rizvi, F. (2006). Imagination and the globalization of educational policy research. *Globalization, Societies and Education*, *4*(2), 193-205.

Robitaille, D. F., & Travers, K. J. (1992). International studies of achievement in mathematics. In D. A. Grouws (Ed.), *Handbook of research in mathematics teaching and learning* (pp. 687-709). New York, NY: Macmillan Publishing Company.

Rosa, M., & Orey, D. C. (2011). Ethnomathematics: The cultural aspects of mathematics. *Revista Latinoamericana de Etnomatemática*, 4(2), 32-54.

Sam, L. (1999). *Public image of mathematics (*Unpublished Doctoral dissertation). Curtin University of Technology, Perth, Australia.

Schubert, W. H. (1986). *The curriculum: perspective, paradigm and possibility*. New York, NY: Macmillan.

Shrestha, I. M. (2018). *My pedagogical sensitization towards holistic mathematics education: A practitioner's inquiry* (Unpublished dissertation for Master of Philosophy in Mathematics Education). Kathmandu University, Nepal.

Shrestha, I. M. (2019). Facilitating culturally de/contextualized Mathematics education. In P. C. Taylor & B. C. Luitel (Eds.), *Research as Transformative Learning for Sustainable Futures* (pp. 19-37): Brill Sense.

Shrestha, M. (2018). *Cognitive embodiment of geometry in traditional Newari art: An ethnographic inquiry* (Unpublished dissertation for Master of Mathematics Education). Kathmandu University, Nepal.

Solonchak, T., & Pesina, S. (2015). Cognitive properties of images and metaphors. *Procedia-Social and Behavioral Sciences*, *192*, 650-655.

Spry, T. (2018). Autoethnography and the other: Performative embodiment and a bid for utopia. In Denzin, N. K., & Lincoln, Y. S. (Eds.), *The Sage Handbook of Qualitative Research* (5th ed.). Thousand Oaks, CA: Sage.

St Pierre, E. A. (2018). Writing: A method of inquiry. In N. K. Denzin, & Y. S. Lincoln (Eds.), *The Sage Handbook of Qualitative Research* (5th ed. pp. 1423 -1431). Thousand Oaks, CA: Sage.

Stroud, A., & Baines, L. (2019). Inquiry, Investigative Processes, Art, and Writing in STEAM. In Khine, M. S., & Areepattamannil, S. (Eds.) *STEAM Education: Theory and Practice* (pp. 1-18). Springer.

Taylor, P. C. (2016). Why is a STEAM Curriculum Perspective Crucial to the 21st Century? In *14th Annual conference of the Australian Council for Educational Research*, 7 - 9 August 2016, Brisbane.

Taylor, P. C., & Medina, M. N. (2019). Teaching and Learning Transformative Research: Complexity, Challenge and Change. In *Research as Transformative Learning for Sustainable Futures* (pp. 39-57). Brill Sense.

Taylor, P. C., & Taylor, E. (2019). Transformative STEAM Education for Sustainable Development. In Rahmawati, Y., & Taylor, P. C. (Eds.). *Empowering Science and Mathematics for Global Competitiveness: Proceedings of the Science and Mathematics International Conference (SMIC 2018), November 2-4, 2018, Jakarta, Indonesia*. CRC Press.

Taylor, P. C., Taylor, E. L., & Luitel, B. C. (2012). Multi-paradigmatic transformative research as/for teacher education: An integral perspective. In *Second International Handbook of Science Education* (pp. 373-387). Netherlands: Springer.

Taylor, P., & Medina, M. (2013). Educational Research Paradigms: From Positivism to Multiparadigmatic. *Journal of Meaning Centred Education, 1*(1).

Taylor, P.C. (2013). Research as transformative learning for meaning-centred professional development. In O. Kovbasyuk & P. Blessinger (Eds.), *Meaning Centred Education: International Perspectives and Explorations in Higher Education*. London: Routledge.

Taylor, S. J., & Bogdan, R. (1998). In-depth interviewing. *Introduction to Qualitative Research Methods, 3*(1), 87-116.

Tomlinson, C. A. (2014). *The differentiated classroom: Responding to the needs of all learners*. ASCD.

Tomlinson, C. A., & Eidson, C. C. (2003). *Differentiation in practice: A resource guide for differentiating curriculum, grades k-5*. ASCD.

Tomlinson, C. A., & McTighe, J. (2006). *Integrating Differentiated Instruction & Understanding by Design: Connecting Content and kids*. ASCD.

Trench, W. F. (2013). *Introduction to Real Analysis.* Library of Congress cataloging-in-publication data. ISBN 0-13-045786-8.

Van Manen, M. (1991). *The tact of Teaching: The Meaning of Pedagogical Thoughtfulness.* Routledge, Taylor and Francis: London and New York.

Varkøy, Ø. (2007). Instrumentalism in the Field of Music Education: Are We All Humanists? *Philosophy of Music Education Review*, 37-52.

Vygotsky, L. (1978). Socio-cultural theory. In M. Cole, V. John-Steiner, S. Scribner, & E. Souberman (Eds.), Mind in society: Development of higher psychological processes (p. 198). Cambridge, MA: Harvard University Press.

Willis, J. (2007). *Foundations of Qualitative Research: Interpretive and Critical Approaches.* Thousand Oaks, CA: Sage.

Willmott, R. (1999). Structure, agency and the sociology of education: Rescuing analytical dualism. *British Journal of Sociology of Education, 20*(1), 5–21.

Wolk, R. A. (2011). *Wasting Minds: Why our Education System is Failing and what we can do about it*. ASCD.

Xiangming, C. (2015). Meaning-Making of Chinese Teachers in the Curriculum Reform. In Hua. Z & Pinar, W. F. (Eds.), *Autobiography and Teacher Development in China: Subjectivity and Culture in Curriculum Reform.* New York, NY: Macmillan.

Yakman, G. (2008, February). STEAM education: An overview of creating a model of integrative education. In *Pupils' Attitudes towards Technology (PATT-19)*

Conference: Research on Technology, Innovation, Design & Engineering Teaching, Salt Lake City, Utah, USA.