Science and Mathematics Education Centre

Culture, Worldview and Transformative Philosophy of Mathematics Education in Nepal: A Cultural-Philosophical Inquiry

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Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of my knowledge belief this thesis contains no material previously published by any other person or institution except where due acknowledgement has been made.

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Bal Chandra Luitel

Date: 24/07/2009

❁ शिवोम् ❁

सत्यस्य बचनम् श्रेयः सत्यादपि हिताबदेत्।
यद्भूतहितमत्यन्त एतत् सत्य मतं मम।।

(Trans: Telling truth is recommended, but more than that, tell those things which are in the broader interests of all. For me (i.e., Narada), that which is beneficial to the large community, is truth. - Mahabharata)

DEDICATION

To all known and unknown teachers, gurus, avatars, Buddhas, yogis, sages, philosophers and unnamed higher spirits (not in a particular order) who bestow knowledge and wisdoms on me in this life time.

To my parents (father Hari Prasad Luitel and mother Late Pabitra Luitel) whose ideals of value-based living have been guiding my life along a valuable educational journey.

To my brother Late Ram Chandra Luitel whose honesty, dedication and educative role inspired me to be a good teacher.

To my wife, Sabita, whose care, warmth and continuous love and support has made my 'seeking life' exciting and rewarding.

To my sons, Bijaya and Binaya, who have important roles to play in their future lives.

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My sincere thanks go to my co-supervisor Dr. Lily Settelmaier whose critical comments and questions on issues related to various contemporary issues arising from Eastern Wisdom Traditions, especially nondualism, integralism and .

A special gratitude to my parents who made me able to see the world in a unique way that every creature should be treated with care, compassion and sympathy. *Although I could not share this outcome of your education during your physical presence, I owe you so much Mother and feel that you are always with me!*

Many thanks to my parents-in-law, brothers, sisters, sisters-in-law, brothers-in-law, and other well wishers from my extended family for their continuous moral support in my studies.

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ABSTRACT

This thesis portrays my multifaceted and emergent inquiry into the protracted problem of culturally decontextualised mathematics education faced by students of Nepal, a culturally diverse country of south Asia with more than 90 language groups. I generated initial research questions on the basis of my history as a student of primary, secondary and university levels of education in Nepal, my Master's research project, and my professional experiences as a teacher educator working in a university of Nepal between 2004 and 2006. Through an autobiographical excavation of my experiences of culturally decontextualised mathematics education, I came up with several emergent research questions, leading to six key themes of this inquiry: (i) hegemony of the unidimensional nature of *mathematics as a body of pure knowledge*, (ii) unhelpful dualisms in mathematics education, (iii) disempowering reductionisms in curricular and pedagogical aspects, (iv) narrowly conceived 'logics' that do not account for meaningful lifeworld-oriented thinking in mathematics teaching and learning, (v) uncritical attitudes towards the image of *curriculum as a thing* or *object*, and (vi) narrowly conceived notions of globalisation, foundationalism and mathematical language that give rise to a decontextualised mathematics teacher education program.

With these research themes at my disposal my aim in this research was twofold. Primarily, I intended to explore, explain and interpret problems, issues and dilemmas arising from and embedded in the research questions. Such an epistemic activity of articulation was followed by envisioning, an act of imagining futures together with reflexivity, perspectival language and inclusive vision logics.

In order to carry out both epistemic activities – articulating and envisioning – I employed a multi-paradigmatic research design space, taking on board mainly the paradigms of criticalism, postmodernism, interpretivism and integralism. The critical paradigm offered a critical outlook needed to identify the research problem, to reflect upon my experiences as a mathematics teacher and teacher educator, and to make my lifetime's subjectivities transparent to readers, whereas the paradigm of postmodernism enabled me to construct multiple genres for cultivating different aspects of my experiences of culturally decontextualised mathematics education. The

paradigm of interpretivism enabled me to employ emergence as the hallmark of my inquiry, and the paradigm of integralism acted as an inclusive meta-theory of the multi-paradigmatic design space for portraying my vision of an inclusive mathematics education in Nepal.

Within this multi-paradigmatic design space, I chose autoethnography and small p philosophical inquiry as my methodological referents. Autoethnography helped generate the research text of my cultural-professional contexts, whereas small p philosophical inquiry enabled me to generate new knowledge via a host of innovative epistemologies that have the goal of deepening understanding of normal educational practices by examining them critically, identifying underpinning assumptions, and reconstructing them through scholarly interpretations and envisioning. Visions cultivated through this research include: (i) an inclusive and multidimensional image of the nature of mathematics as an im/pure knowledge system, (ii) the metaphors of thirdspace and dissolution for conceiving an inclusive mathematics education, (iii) a multilogical perspective for morphing the hegemony of reductionism-inspired mathematics education, (iv) an inclusive image of *mathematics curriculum as montage* that provides a basis for incorporating different knowledge systems in mathematics education, and (v) perspectives of glocalisation, healthy scepticism and multilevel contextualisation for constructing an inclusive mathematics teacher education program.

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SECTION ZERO: SITUATING MYSELF: RESEARCH AGENDAS AND DESIGN

Section Zero comprises two chapters, Chapter -1 and Chapter 0. I have chosen these unconventional chapter titles to depict the diachronic nature of my inquiry. A diachronic inquiry grows out of time, making actions intelligible in terms of what has transpired and is bygone (Polkinghorne, 1992). Chapter -1 presents my journey of encountering the research problem of culturally decontextualised mathematics education as a student, teacher and teacher educator in Nepal. The title, Minus One, has been taken to represent an autobiographical excavation of my experiential encounters of culturally decontextualised mathematics education from an earlier moment before I started undertaking this research in a formal sense. Similarly, Chapter 0 is taken to represent the next moment of my journey of conceptualising the research design. Nevertheless, I do not intend to give an impression (via Minus One and Zero) that my research follows an exclusively linear timeline; rather I intend to make sense of my inquiry in terms of my professional encounters over time. As a matter of convention, I have used the symbol '/' (e.g., un/certain, im/pure, un/wittingly) to represents dialectical relationship between sometimes opposing entities, ideas and concepts.

CHAPTER -1: ALL THIS BEGAN FROM THERE —ARTICULATING MY RESEARCH PROBLEM

In this chapter, I explore my autobiographical impulses (e.g., Spry, 2001) as a basis for identifying research questions based on my experiences as a student, mathematics teacher and teacher educator in Nepal. Central to this excavation are several aspects of culturally decontextualised mathematics education, such as the image of foreign mathematics in my primary education, the hegemony of didactic pedagogies during my secondary and post-secondary education, and a narrowly conceived view of mathematics curriculum in my role as a curriculum worker, to name a few. The chapter also presents a snippet of other researchers' knowledge claims in relation to the broader significance of my research agendas.

Encountering Foreign Mathematics

I start by reflecting upon my formal educational journey which commenced in the late 1970s in a rural primary school of Nepal. It was a time when the country was heading towards a historical referendum to choose between a 'party-less' political system and multiparty democracy. I remember going to see mass demonstrations and rallies in favour of multiparty democracy. I never knew the result of this referendum until I grew up enough to read books and recently available magazines about resistant politics against the party-less *Panchayati* regime. Perhaps, the agrarian-based village population was highly sensitive to its political aspirations although they had limited modern facilities (a health post, one high school, three primary schools and a post office) available to them.

Whilst writing about these experiences, I feel that becoming a school goer entailed accepting the image of a non-village person 'going away' (becoming a modern or global person?) after completing secondary level education in the village. While I was coming to realise the big differences between my day-to-day world and the world of school I began to wonder why there were no contextual stories in my mathematics textbook. Constructing the image of *mathematics as a foreign subject* thrust me into the dilemma that becoming a mathematics student required me to forget the songs of birds and rivers that I had grown up with.

On completing my three-grade primary school, I was ready to go to the only high school in my village. While continuing my education in the high school, my earlier

image of *mathematics as a foreign subject* was further reinforced by school mathematics continuing to stay away from my heart, spirit and cultural context. From the beginning of grade four I saw the subject of mathematics beginning to separate into three distinct unconnected areas - arithmetic, algebra and geometry - and being more abstract, algorithmic and decontextualised in nature. Whilst I started being successful in poetry recitation, essay writing and public speaking competitions organised by the school, my performance in mathematics was at a record low by the end of grade five. Consequently, I continued to construct other images of mathematics, such as *mathematics as a lifeless subject,* while also keeping in mind my earlier image of *mathematics as a foreign subject*. With the construction of these images, I began to raise this question, albeit implicitly: *Can mathematics be compatible with poetry and stories that I have been writing? If not, why?*

Arriving at grade six, I was summoned by my eldest brother and asked to focus more

on my mathematics as I was underperforming compared to other subjects. I needed to rote memorise a large number of formulas and rules of algebra. Although I was motivated more to write for my school's poetry recitation competition, I spent many hours blindly repeating mathematical rules and selected problems and preparing charts of important formulas and rules. Although my mathematics was getting better in the eyes of my teacher and my eldest brother, the image of *mathematics as a collection of meaningless symbols* was becoming prominent in my experiential world. Our mathematics classrooms were the hallmark of the didactic trilogy of the teacher, textbook and blackboard. As I write about these experiences I remember that the teacher would present many would-be tragic scenarios if we did not rote memorise correctly the endless formulae and definitions. The textbook was also a source of tragedy because it would invalidate my otherwise different methods of solving algorithmic problems. The blackboard was yet another source of tragedy because it never demonstrated creative ways of doing mathematics. More so, the myth that there should be only one correct answer created a series of tragic episodes of mathematics learning in which most of us ‘failed’ to understand mathematics in the teacher’s terms. During this period, these three questions germinated in my thinking: *Why do mathematics teachers use didactic pedagogy? Cannot there be other methods of teaching mathematics?*

Arriving at grade eight, I started to realise the scarcity of mathematics and science teachers in our school. Stories shared by school management committee members about their travels of searching for mathematics and science teachers in northern Indian villages started to echo in me as our school did not have a qualified mathematics teacher to teach *optional mathematics*[1] and science in grades nine and ten. The school found one teacher but he disappeared after a week.

Perhaps, the situation of not having a qualified teacher of mathematics at the secondary level led me to pursue a teaching career by opting for mathematics as a major subject in my intermediate education[2]. Initially, the mathematics lecturer of our college refused to accept us as mathematics students because none of us had studied additional (i.e., optional) mathematics in our secondary education. However, there was no official rule that we could not opt for a mathematics stream in our tertiary education. At this time I constructed an image of *mathematics as a tool of segregation.* After a week or so, the standoff with the college lecturer came to an end with an unwritten agreement that he would start taking the class. However, his refusal to explain mathematical problems in the Nepali language caused me to construct an image of

[1] According to school mathematics curriculum of Nepal, optional mathematics is additional mathematics which is generally chosen by academically bright students.
[2] Similar to senior/higher secondary level.

mathematics as an inexplicable subject in Nepali. At this stage, this question came to my mind: *Can mathematics not be fully explained according to Nepali cultural contexts?*

Transition to Meaningless Mathematics

Upon reflection, a great deal of my learning experiences of undergraduate mathematics entailed the image of *mathematics as a meaningless subject*, causing me to rethink the type of mathematics that we teach in teacher education programs. Whilst I was teaching from an Anglo Indian mathematics textbook to Nepali students, I witnessed that cultural, conceptual and lingual contradictions were major hindrances to student learning. *Mathematics-teaching-as-reproduction-of-theorems* and *mathematics-as-collections-of-unchangeable-definitions* were some of the images I constructed during my first Master's degree. In the meantime, I had developed a *dim* image of ethnomathematics as *mathematics of the people*. But how could I fully conceive ethnomathematics (probably 'impure' mathematics) whilst 'pure' mathematics had saturated my consciousness about the nature of mathematics?

Leaving my brief career as a tutor in a teacher education college, I joined the University of Himalaya[3] as a mathematics teacher trainer. While working with teachers of semi-rural schools I continued to develop many (helpful) images of *mathematics as storytelling*, *mathematics as cultural enactment* and *mathematics as languaging*. However, this did not mean that the images of mathematics I had developed during this time were all helpful. During a period of three years, I interacted with teachers about their perceptions of the recently changed mathematics curriculum. Perhaps the change was understood to be very important by policymakers, curriculum designers and some university professors. However, for teachers it was just another fad with which to incorporate new topic areas into the

[3] A pseudonym of an Asian University

syllabus. In hindsight, I could see teachers demanding a more reality-based image of mathematics, whereas the experts' image of mathematics matched my earlier image of *mathematics as a foreign subject*. But how could I reconcile these different viewpoints about the nature of mathematics?

My Master's Research Project: A Stepping Stone

In 2002, I had an opportunity to pursue another Master's degree in an overseas university. At the beginning of my course I had envisaged that I would be able to import 'ideas' from overseas into Nepal. This naïve notion of importing could be an expression of my long-standing frustration of learning meaningless mathematics or it could entail a colonised (i.e., comprador) mindset that always considered importing knowledge from outside the country. Consequently, I constructed an image of *mathematics as an object to be imported*.

As I remember now, my earlier image of the would-be-imported mathematics started to fall apart together with progress in my study. As a culminating requirement, I undertook a research project (see Luitel, 2003) to investigate aspects of culturally decontextualised mathematics education, wherein I engaged in narrative envisioning to explore possible alternatives. Starting with the initial question, *How do the school mathematics curricula of Nepal subscribe to different curriculum metaphors for developing a culturally relevant and contextualised mathematics curriculum?,* the research project demonstrated how pluralism and difference are important in my life as a teacher educator situated in a country with more than 90 language groups and a multitude of cultural-spiritual traditions.

In this process of generating critiques of decontextualised mathematics pedagogy, I articulated different voices arising from my experiences. Such voices helped me to (i) deconstruct the hegemony of abstract and algorithmic mathematics, (ii) reveal disempowering features of transmissionist and didactic pedagogy, (iii) identify empowering curriculum perspectives that can facilitate an inclusive mathematics education, and (iv) demonstrate the importance of pluralism and difference for conceiving an inclusive mathematics education.

Abstract and algorithmic mathematics

My Master's research project examined the widespread hegemony of abstract and algorithmic mathematics that I had encountered at critical moments of my educational journey. Specifically, the research project put brushstrokes on my autobiographic impulses of encountering algebra in primary education, studying calculus in my undergraduate courses and being in a statistics class during my first Master's course in a Nepali university. The following vignette from my project demonstrates my impression of the far-reaching consequences of abstract and symbolic mathematics exclusively promoted by school mathematics education in Nepal:

> …as the uncritical curricula and pedagogy *did* focus on the symbolic representations as unchangeable entities, the power of the mathematics was lost somewhere. Put simply, the symbols were made so dry that there were no *lives*. In my experience, there may be a danger in diverting the power of symbols to the power of someone. (Luitel, 2003, p. 34)

This aspect of my Master's research appears to be related to the nature of mathematics, thereby giving rise to further inquiry into this aspect of culturally decontextualised mathematics education.

Transmissionist and didactic pedagogy

The second outcome of the Master's project was a heightened awareness in me that transmissionist and didactic pedagogies are very influential means for retaining decontextualised mathematics education in Nepal. In the research project I elucidated how the disempowering pedagogical models of *listen-repeat-remember-recall* and *do-what-your-teacher-says* were rampant in my primary and secondary education. In critiquing transmissionist pedagogies I discussed many cases of monological pedagogies where students are treated as muted followers who never raise questions. The hallmark of these pedagogical practices is to reduce teaching to knowledge transmission and promote unhelpful dualisms. Given the limited scope of the research project I could not inquire further into the far-reaching consequences of many unhelpful dualisms and the prevailing reductionism that I had detected in mathematics education.

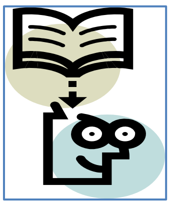
Pluralism and difference

My Master's research project demonstrated how pluralism and difference could be the much needed perspectival means for challenging the hegemony of singularity vested in decontextualised mathematics education. In that research project, I discussed briefly how a foreign mathematics can be transformed into a native (sic) mathematics, thereby advocating the inclusion of culturally situated diverse mathematical practices in mathematics curriculum and pedagogy.

Next, my research project demonstrated ways of promoting pluralism and difference by using an autoethnographic inquiry that examined my past and present experiences as a student, teacher and teacher educator. With the help of multiple genres I articulated different ways of expressing my pedagogical knowing in context. Specifically, storied, reflective, theatrical and poetic genres helped me speak from

different ontological (and epistemological) spaces. More so, as I valued (and still do) promoting leaner-friendly, culturally contextualised and inclusive mathematics education, the positivistic emphasis on valuing 'objective' knowledge claims[4] (insofar as those claims would promote empowering agendas) was almost undermined. In this process, I generated critiques of culturally decontextualised mathematics education in terms of its pedagogy and epistemology (ways of knowing). Consequently, this aspect of my Master's project has given rise to an emergent inquiry into how key logics (ways of thinking) orient the culturally decontextualised mathematics education that is widespread in Nepal.

Curriculum images



Another important outcome of my Master's research project was an exploration of different mathematics curriculum images within which I had previously studied and taught. I identified a host of

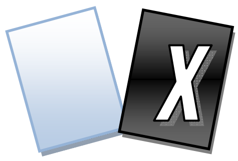
[4] Indeed, my preference is not to use objective and subjective as oppositional poles of thinking, rather I prefer to use them as complementary typologies of different types of knowledge (Sections One, Four and Five).

disempowering images, including *curriculum as subject matter, cultural reproduction, power imposition, silence, centrally prepared document, author's text* and *discrete tasks and concepts*, to name a few. I termed them disempowering images because they are likely to undermine agentic aspects of mathematics pedagogy. In the process, I explored a set of agency-oriented images of curriculum that help conceive a culturally contextualised mathematics education. Such images of mathematics curriculum include *curriculum as local enactment, voice, dynamic text, cultural reconstruction* and *currere*, to name a few. This aspect of my Master's research has given rise to further inquiry into prevailing assumptions orienting the mathematics curriculum in Nepal.

Post-Master's Professional Experience: Déjà vu and Emergent Issues

Dualism all over again

Soon after re-joining the University of Himalaya at the beginning of 2004, I set out a plan for developing and launching a one-year in-service mathematics teacher education program that (hopefully) could be an exemplar of my vision of culturally inclusive mathematics education. In this process, I discussed with a number of school teachers and principals in Kathmandu Valley the nature of the program. I learned that most of the principals were using many unhelpful dualisms as a key orientating means for mathematical pedagogies in their schools, and as a means for promoting exclusionary pedagogies in mathematics. Whilst conversing with principals and teachers about effective mathematics teaching, learning and assessment, their views reminded me of my critical examination of mathematics pedagogy in my Master's project. Such a reminder helped formulate an agenda for this research into the nature, meaning and implications of dualism in mathematics education via these research questions: *In what ways does the exclusive emphasis of dualism not promote an inclusive view of mathematics education? What might be key unhelpful dualisms that orient mathematics education in Nepal?*

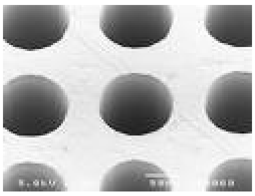


Encountering reductionism

I started teaching the recently launched in-service teacher education program from the middle of 2004. My aim at that time was to promote a multi-perspectival view of mathematics education, thereby generating contextualised (inclusive of rich contexts) pedagogical models of teaching mathematics in schools for in-service teachers. In this process I felt opposition to varying degrees from in-service teachers who held a reductionist view of mathematics teaching as transmission. Whilst working with my students in their practicum and other school-based components of their studies, I came to realise that reductionism orients various aspects of mathematics education of Nepali schools. The situation was a reminder of my critical examination of the exclusive view of teaching as instructing that I had criticised in my Master's project, thereby giving rise to the initial research question for this thesis research: *In what ways is an exclusive emphasis on reductionism unhelpful for realising an inclusive mathematics education in Nepal?*

Holes of curriculum

By the beginning of 2005, I was included in the curriculum committee that worked for revising a mathematics curriculum[5] for the secondary schools of Nepal. During

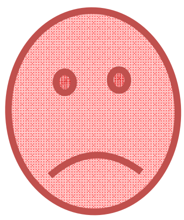


that time, I had discussions with a number of curriculum workers (curriculum officers, experts, specialists and teachers). By being involved in the discourse of designing and implementing the mathematics curriculum, I observed the hegemonic play of narrowly conceived notions of curriculum design and implementation, probably in/visibly guided by a host of modernist curriculum design models. Reflecting upon this moment gives rise now to this question: *What are likely to be key orienting assumptions of mathematics curriculum in Nepal?*

Facing narrow views of globalisation, foundationalism and analytical language

Toward the middle of 2005, I was involved in formulating a two-year mathematics

teacher education program to be launched



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5 m because it was specific to a grade-level.

from the beginning of 2006. In the process of planning the program, I encountered a number of obstacles for developing an inclusive mathematics teacher education program. The sources of these obstacles were: narrow views of globalisation, disempowering views of foundationalism and a unidimensional view of mathematical language. The widespread views of globalisation as Westernisation and universalisation were key sources of impediments towards formulating an inclusive mathematics teacher education, resulting from the widespread view that we need to follow without questioning the model of teacher education used in a 'developed' country, where the notion of developed entails a particular worldview. This narrow view of globalisation gave rise to a key research question for this inquiry: *In what ways do the narrow views of globalisation as Westernisation and universalisation offer a restrictive view of mathematics teacher education?*

I have felt that an exclusive emphasis on foundationalism as the sole framework was a huge hurdle for formulating a teacher education program. Whilst working with teacher educators and mathematics education professors, I came to know that formulating a mathematics teacher education program had been conceived as following psychological and logical foundations. Unsurprisingly, the psychological foundation appeared to be associated with behaviourism and the logical foundation seemed to promote a single view of the logical structure of mathematical knowledge (i.e., hypothetico-deductive logic). More so, I felt that the strong presence of foundationalism militated against any possibility for promoting healthy scepticism. In this way, this critical incident provided me with another initial research question for this inquiry: *In what ways does foundationalism contribute to an exclusionary view of mathematics teacher preparation?*

At the same time I encountered yet another disempowering perspective about the nature of mathematics, especially mathematical language (i.e., mathematical proof). The view that teacher education courses should promote exclusively the analytical language of mathematics did not sound helpful for conceiving a mathematics education that is inclusive of multiple knowledge traditions arising from both local and official mathematics. I felt that a mathematics teacher education with an exclusive emphasis on analytical language would produce future mathematics teachers with narrow views and visions of mathematics education. Arriving at this stage I came up with another initial research question for this inquiry: *Does not the* *call for promoting a narrowly conceived view of mathematical language (i.e., analytical) serve only the agenda of culturally decontextualised mathematics education?*

Deceived by conventional logics

During the first semester of 2006, I taught a unit on the philosophy of mathematics education as well as played the role of course coordinator of the newly launched two-year mathematics teacher education program in the University of Himalaya. Whilst teaching a number of philosophies I aligned myself with heretical views of mathematics in order to transform mathematics education from an exemplar of exclusive decontextualism (sic) to an inclusive learning enterprise. Initially, I rejected conventional views of mathematics arising from Platonism and Formalism with a view that these philosophical schools of mathematics do not promote an inclusive mathematics education. Nevertheless, in this process of dismissal of the conventional view of mathematics, I privileged ‘capital P’ Philosophical Ideas rather than ideas arising from the lived experiences of my students. In a series of discussions with students, I felt that my approach was falling short as I was not promoting inclusive approaches on three fronts. First, the logics embedded in my argument were not different from the propositional, deductive and analytical logic of conventional philosophies. Second, my over-reliance on Philosophical Idea(s) was not addressing philosophies embedded in personal and professional lifeworlds of teachers. Third, I did not consider the view that much needed transformative visions for mathematics education need a serious consideration of inclusive thinking (logics). Given this realisation, I came up with this initial research question for this inquiry: *What might be the key logics that orient mathematics education in Nepal?*

Déjà vu of pure mathematics

At the same time (i.e., first semester of 2006), I encountered some conflicts between students (in-service teachers) and tutors of two mathematics units included in the teacher education program. Students were critical of their tutors’ didactic and transmissionist pedagogies arising from

(possibly) the unidimensional nature of *mathematics as a body of pure knowledge*, where the term 'pure' is a collective expression of disembodied, abstract, algorithmic, objective and symbolic forms of mathematics. Bemused by this situation, I developed the view that one day I would exclude any mathematics units that promote the nature of *mathematics as a body of pure knowledge*, thereby privileging the nature of *mathematics as impure knowledge*, because I held the view that the latter would correct the problem of exclusivity created by decontextualised mathematics education. However, these two views of the nature of mathematics are my recent construction; I am depicting now a range of views about the nature of mathematics of that time through the labels of pure and impure mathematics. Arising from this critical moment is this initial research question: *Which nature of mathematics governs mathematics education in Nepal?*

Reaching Out to the Field: Interacting with My Research Agendas

The biographical sketch of my lifeworld as a student, teacher, researcher and teacher educator has given rise to a number of research agendas including the nature of mathematics, unhelpful dualisms, reductionism in mathematics education, logics (i.e., ways of thinking) and curriculum issues. Are these agendas confined solely to my professional context? In what ways are these agendas related to the broader field of mathematics education research? Although sections of my thesis employ various theoretical referents, which are discussed in detail within their own interpretive contexts, I present here a snippet of my literature review to illustrate the broader significance of the research agendas arising from my otherwise idiosyncratic educational experiences.

Nature of mathematics

This key research agenda has also been a research issue in the field of mathematics education in the last twenty years. In an inquiry into the nexus between teachers' views of the nature of mathematics and their pedagogical practices, Lerman (1990) has suggested a number of alternative views of the nature of mathematics as a basis for promoting learner centralism in mathematics pedagogy. Sympathetic to heretical views of the nature of mathematics, Lerman has taken the Lakatosian notion of

quasi-empiricism as a theoretical basis for exploring fallibalistic views of the nature of mathematics. Unsurprisingly, Lerman seems to suggest that the nature of mathematics *as activity* is more appropriate than the conventional and absolutist nature of mathematics *as a body of knowledge* for justifying student centralism in mathematics education.

Paul Ernest (1994c) has touched upon the issue of the nature of mathematics in his articulation of a social constructivist philosophy of mathematics education. In his attempt to challenge the logical masterplan of the Euclidean paradigm, Ernest builds his 'naturalistic' view of the nature of mathematics - *as a socially constructed knowledge system* - upon what he calls maverick, fallibilist, socio-cultural and quasi-empiricist philosophical traditions. Arguing for a dialogical nature of mathematics, he contends that the monological view of mathematical knowledge does not represent the deeply-permeated conversational nature of mathematical thinking, representation and knowledge claims. A possible consequence of the absolutist philosophy-inspired monological view of mathematics is the lack of an inclusive vision for addressing gender and minority related issues (Walshaw, 2005). Situated within the Western intellectual traditions, Ernest claims that mathematical proofs were taken to embody reasonableness, dialogue, dialectical thinking and democratic pedagogy which have sadly symbolised closure, monological truth, dualistic thinking and autocratic pedagogies under the auspices of the absolutist nature of *mathematics as a body of infallible knowledge*.

Arguing from a socio-cultural-historical perspective, Reuben Hersh is critical of the nature of mathematics arising from what he calls 'foundationist' philosophies of mathematics, including Platonism, Formalism and Logicism. In his book, *What Is Mathematics Really?*, Hersh (1997), as a practising mathematician and mathematics educator, gives insight into the view of mathematics constructed by centuries of human endeavours. It can be said that Hersh's approach to an anti-foundationist view of the nature of mathematics is similar to those of Ernest and Lerman because he is also in pursuit of the anti-foundationist (similar to maverick and fallibilistic) nature of mathematics which can represent a holistic picture of both the process and product of mathematical knowledge claims. Although Hersh has made quite a naive statement: 'The literature on non-Western mathematics is valuable, but it's not philosophical' (p. xv), he argues nonetheless for an inclusive view of the nature of mathematics as constitutive of socially constructed ideas, objects and entities. More so, he seems to promote the nature of mathematical knowledge that 'is part of human culture and history, which are rooted in our biological nature and our physical and biological surroundings' (p.17).

Another sub-set of my review constitutes researchers and pioneers of the cultural-political dimension of mathematics. D'Ambrosio (2006) develops a view of using mathematics education recognisant of non-Western cultural traditions. His emphasis on the cultural nature of mathematics challenges the otherwise unchallenged politically motivated view of culture-free mathematics. Consequently, D'Ambrosio's program of ethnomathematics has triggered a wave of developing culturally contextualised mathematics education, with varying (often contrasting) views of culture. With the partial acceptance of D'Ambrosio's research program as a basis for preparing learners for active and critical citizenship, critical mathematics educators point to the possibility of 'culture' and 'ethno' becoming bases for unexamined false consciousness. This group of mathematics educators seems to subscribe to a fallibilistic view of mathematical knowledge with an emphasis on agency-oriented pedagogies (Skovsmose, 2005).

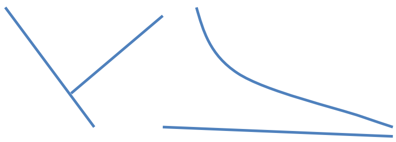
These philosophical perspectives to a large extent have been a source of my thinking and actions in the last four years. My experience also suggests that an extreme form of uni-dimensional absolutist view of the nature of mathematics promotes antidemocratic, elitist, gender-insensitive and culture-insensitive mathematics education (Walshaw, 2001), thereby giving rise to the need for my inquiry to address the multidimensional nature of mathematics. Having inherited Vedantic and Buddhist perspectives of the nature of everything (including mathematics), I often find it difficult to accept that any linguistic label (be it absolutist or relativistic) has a permanent essence (Eliot, 1998; Fausset, 1976). Indeed, my emphasis in this research is not on generating yet another 'capital P' Philosophy of mathematics education, rather my interest is in exploring the multi-dimensional nature of mathematics education that makes better sense of my professional lifeworlds as a mathematics teacher educator. Arriving at this stage, I formulate another research question for this inquiry: *How can a multi-dimensional nature of mathematics be conceived as a basis for an inclusive mathematics education?*

Unhelpful dualisms

Gergen (1995) has discussed the intellectual history of Western civilisation in terms of its locking in since antiquity the unhelpful debacle of the excogenic versus endogenic nature of knowledge. Here excogenic refers to the view of knowledge as existing outside of the human mind, whereas endogenic promotes the view of knowledge as an exclusively mental construction. Gergen refers to a number of cases as to how this basis has given rise to a number of dualistic perspectives, including that which is expressed through the language of cognitivism versus behaviourism, rational versus empirical, and *a priori* versus *a posteriori*. Research studies seem to suggest that these debacles are reflected in mathematics classrooms where the duality of a 'right versus wrong' orientation locks teachers and students into restricted images of *teaching as 'good' telling* and *learning as attentive listening* (Cooney, 1999). Cooney argues that a dualistic orientation toward mathematics education gives rise to an emphasis on mathematics *as finished product*, such as the acquisition of algorithms *sans* meaning.

Similarly, Cobb (1994) discusses how constructivism and socio-cultural perspectives tell half good stories about mathematical learning which has been (dis)oriented by the centuries-old mind-body dualism. Cobb seems to refer to Vygotskian and other anthropological (and cultural?) traditions as socio-cultural perspectives and radical constructivism as constructivism. According to Cobb, the dualism of *external socio-cultural* versus *internal individual* also can be misleading because of the inadequacy of each one in accounting for the opposite aspect. For example, if radical constructivist accounts of learning get primacy over those of the socio-cultural then it may be difficult to present an inclusive view of learning, thereby un/wittingly cultivating exclusionary worldviews (Cobb, 1994; Cobb, Yackel, & Wood, 1992).

It appears to me that the source of dualism in mathematics education is un/wittingly linked to the protracted problem of mind-body dualism that can also be arising from Gergen's endogenic versus excogenic view of knowledge. In mathematics education this duality has been helpful in spreading the unexamined perception of mathematical knowledge as exclusively disembodied (Lakoff & Nunez, 2000; Nuñez, 2006). Such



a view of mathematical knowledge regards the mind as an abstract entity, disconnected from and surpassing the body. Consequently, such a duality promotes the view that mathematical thinking is also non-corporeal, decontextualised, timeless and universal (Núñez, Edwards, & Filipe Matos, 1999), thereby creating a safe haven for an exclusive mathematics education that privileges a particular form of knowledge (i.e., disembodied, decontextualised, abstract, algorithmic). More so, it can be this dualistic worldview that legitimates a particular form of knowledge, pedagogical methods and assessment techniques.

According to educational researchers who use complexity science[6] as their framework (e.g., Davis & Sumara, 2006; Doll, 2008; Fleener, 2005; Haggis, 2008), one of the sources of exclusive dualism in education is the in/visible hegemony of the paradigm of Euclidean Geometry and Newtonian Science. Euclidean Geometry is a source of simplistic dichotomies of in-out, right-wrong, normal-oblique which are taken to be natural and permanent in educational discourses. The paradigm of Newtonian Science underpins dualism as its orienting worldview for explaining the process of knowledge claims. The dualisms of observer versus observed, noumenon versus phenomenon and metaphysics versus physics are some examples that un/wittingly prevent the discourse of research, curriculum and pedagogy in mathematics education from being inclusive of oppositional and complementary perspectives. Doll's (2008) argument is that explaining multilevel, plural, composite, complicated and complex educational phenomena requires a shift from dualistic and simplistic thinking to multilevel and complexity thinking.

[6] Complexity science studies the common properties of systems considered to be complex in nature, society and science.

Given these theoretical perspectives, my inquiry under the theme of unhelpful dualisms examines how I encountered a number of unhelpful dualisms as a teacher educator. Influenced partly by Rorty (Bagni, 2008), Madhyamika (i.e., the middle way) Buddhism (Nagarjuna, Bhattacharya, Johnston, & Kunst, 1990) and Advaita (i.e., non-dual) Vedanta (Sankaracharya, 1970), my exploration of unhelpful dualisms has also been facilitated by a non-essentialist view of language. In Rorty's (1988) view, the use of human languages reflects a coping strategy in context rather than an ultimate representation of the inherent nature of objects. For example, my writing in this section of the chapter can be regarded as my coping strategy as a researcher who needs to be linked with the community of relevant research agendas. Viewed from within this perspective, dualism is one of many coping strategies to work with complex educational concepts. However, the problem lies in the conception of dualistic representations as ultimate and unchanging, a problem that has been the key source of these research questions for this inquiry: *What are likely to be key unhelpful dualisms that turn mathematics education in Nepal into an elitist enterprise? How can I apply inclusive pedagogical visions to overcome such dualisms?*

Exclusive reductionism

Whilst identifying dualism as a key feature of the paradigm of Newtonian Science, complexity education researchers are also wary of exclusive reductionism being a dominant ideology in the field of educational discourses as a means for restricting teachers and teacher educators from being transformative thinkers and actors (Fleener, 2005). Here the notion of transformation is used to denote a structural shift in applying creative approaches to solving educational problems, such as learning difficulties faced by students, the nexus between assessment and curriculum, and meaning-making through mathematical concepts (Fleener, 2002). Such a shift is likely to occur in many ways; one of which is to suspend exclusive reductionism as a first step towards addressing such problems. Complexity researchers, such as Doll (2005) and Rasmussen (2005), argue for the habit of unending shared inquiry that can form a complex matrix of emergent and pre-existing educational experiences as opposed to the discrete reductionist approach to educational inquiry. Complexity researchers have offered me alternative worldviews to embody emergence and holism, thereby demonstrating ways of addressing the exclusionary landscape of mathematics education created by reductionism.

Whereas complexity researchers urge pedagogues and curriculum workers to pay attention to the complex nature of the educational undertaking, researchers working in the area of gender relate extreme reductionism in mathematics education to an attitude of favouring a masculine way of thinking and being (Keitel, 1998; Walshaw, 2005). Feminist researchers working for an inclusive and justice-oriented education (e.g., Lather, 2008; Walkerdine, 1998) have identified reductionism as the key challenge of our time because it un/wittingly legitimates a Western, White and Masculine (sic) view of research and pedagogy. More so, they implicate mathematics education in serving the reductionist interest of the Western, White and Masculine (cf. masculine) view. Reductionism, according to them, is also expressed through the modernist emphasis on a singular knowledge system operated via decontextualisation (i.e., abstraction, categorisation and rationalisation). Accepting aspects of feminist critique of Westocentric (*sic*) mathematics education, I construct yet another research question for this inquiry: *In what ways does reductionism promote decontextualised mathematics education in Nepal?*

Old and new logics

Joe Kincheloe's idea of postformalism entails an inclusive view of thinking as opposed to the invisible exclusivity promoted by formal thinking (Kincheloe, 2006). One of the best possible explanations of formal thinking in mathematics education can be found in Piaget's use of hypothetico-deductive logic in explaining the phenomenon of learning through the three possible steps of accommodation, assimilation and equilibration. Indeed, Piaget is one of the few educational theorizers who articulated the logical dimension of his genetic epistemology (Piaget, 1998). However, Piaget seems to be unaware that the hypothetico-deductive model, which comprises propositional, deductive and analytical logics, is insufficient to make sense of complexities enshrined in the phenomenon of learning. Postformalism, on the other hand, is an approach to move beyond the mechanistic reasoning of the hypothetic-

deductive model, thereby putting emphasis on meaning, emancipation, ideological disembedding and self-production (Kincheloe & Steinberg, 1999).

According to Wilber (2000d, 2001b, 2007), Piagetian hypothetico-deductive thinking is useful for *describing* phenomena, concepts and events of our experience. However, this thinking model falls short in accounting for logics that are used for envisioning, for the hypothetico-deductive model is less likely to go beyond literalist 'is-centric' language. With this view, Wilber hints at the possibility of postformal thinking arising from metaphorical, dialectical and poetic logics. My inquiry under this theme explores these logics so as to help envision an inclusive mathematics education.

Complexity education researchers (e.g., Davis, 2005; Doll, 2005; Smitherman, 2005; St. Julien, 2005; Trueit, 2005) challenge the hegemony of conventional logics (i.e., propositional, deductive and analytical) in education. Trueit critiques the narrow notion of rationalism as a basis for the ordered and causal worldview of modernity that treats causality and orderliness (of ideas) as unchanging givens in the curricular and pedagogic discourses. She argues that Cartesian egotistic thinking of self has given rise to reductive rationality, thereby hinting at the need for holistic (and poetic) rationality. In a similar vein, St. Julien identifies mainly two types of logics: reduction and complexity. The logic of reduction operates through the disempowering notion that the most valuable knowledge is universal and certain whereas the logic of complexity uses interconnection, recursion, soft prediction and multiple causations for making sense of complex educational phenomena. More so, Smitherman (2005) argues for a perspective of connectivity, as opposed to dichotomy, as a basis for making good sense of educational phenomena. With these classificatory discussions, I have come up with this research question for my inquiry: *What might be possible alternative logics that are likely to help construct a vision for an inclusive mathematics education?*

Curriculum issues

I have come to know that modernist views of curriculum are embedded in the twentieth-century machine models of curriculum development, such as those of Ralph Tyler and Hilda Taba (Apple, 2004; Doll, 2002; Pinar, 2004). The key hallmarks of modernist curriculum models are: *prescriptive language*, *simplistic* *representation of educational reality* and *unidimensional educational outcomes*. More so, modernist curriculum models are likely to promote a view of reality as stable equilibrium which does not allow us to conceive a dynamic view of reality. According to Pinar, modernist curriculum models un/wittingly promote a prescriptive design view of curriculum, thereby not paying the much needed attention to contextual issues.

Postmodern curriculum perspectives depart from the modernist conception of curriculum as a thing or object, thereby opening up dimensions of meaning, context and learners' personal experiences (Slattery, 1995). Such a departure can be characterised by pluralism in conceiving the notion of curriculum, meaning that curriculum within postmodernity constitutes cultural, social, political, textual, historical and autobiographical expressions. Whereas the modernist view of curriculum puts emphasis on transmission of knowledge, postmodern counterparts help critique the disempowering transmissionist culture which is one of the strategies for keeping grand narratives unchanging. Unsurprisingly, postmodern curriculum perspectives promote local and contextual narratives, thereby advocating creative subjectivities as an epistemic basis.

Furthermore, Doll (1993, 2005) articulates his postmodern vision as being inclusive of some good aspects of modernity whereas Kincheloe calls for the use of constructive aspects of postmodernism in articulating teachers' curriculum practices. Doll reveals that modernist curriculum perspectives are less likely to account for the emerging and dynamic nature of knowledge and knowing. Slattery gives rise to the notion of eclectic postmodernism being an opener for creative and transformative thinking that does not simply indulge in deconstruction but also engages in creative eclectic thinking. Given this exploration, I have constructed yet another research question for my inquiry: *In what ways can I develop a transformative curriculum vision for a mathematics education that is inclusive of sometimes opposing knowledge systems, perspectives and ideologies?*

Section Zero

Globalisation, foundationalism and analytical language

Paola Valero and Ole Skovsmose (2005) discuss paradoxes of inclusion and citizenship whilst articulating the nexus between social justice and mathematics education. Whereas the paradox of citizenship is related to the conflict between the emphasis on active citizenry and adaptability in the hitherto socio-cultural context, the paradox of inclusion refers to current practices of globalisation, which has been presented as a means for inclusion, but which actually promotes exclusionary perspectives and practices in mathematics education. Other researchers (Fossa, 2006; Joseph, 2000) addressing the issue of globalisation and the cultural contextualisation of mathematics education have raised similar paradoxes inasmuch as globalisation has been represented through a host of metonymical constructs (e.g., entire mathematics is absolute, the totality of mathematics is abstract) which present an exclusionary picture of mathematics education in terms of knowledge traditions to be included, pedagogical practices to be cultivated and methods of knowing to be promoted (Gutstein, 2003). Perhaps, it is contextual to mention here that the source of paradoxes and contradictions is largely the mode of thinking that is often guided by dualistic logics (Basseches, 2005).

Elsewhere, Ernest (1991, 1994b) has presented five ideological groups in mathematics education. Among them, industrial trainer, technological pragmatist and old humanist seem to promote a foundationalist view of mathematics, meaning that mathematics rests upon unchanging truths which cannot be refuted, altered or replaced. More so, these ideological groups seem to advocate a restrictive view of mathematical language similar to that which I have encountered in the past as a student and recently as a teacher educator. Their foundationalist view has influenced mathematics teacher education in a number of ways: mathematics teaching is all about transmitting unchanging mathematical knowledge, learning in mathematics should be guided by valid psychological theory, and assessment in mathematics education should ascertain whether students have reproduced intended mathematical ideas and concepts (Ravitch, June 26, 2005; Rowlands & Carson, 2004). Given these perspectives, I have come up with further research questions for my inquiry: *In what ways do exclusive views of globalisation, an extreme view of foundationalism, and a narrowly conceived notion of mathematical language restrict mathematics teacher education programs from becoming an inclusive and transformative educational* *endeavour? What are likely to be key perspectives that overcome such exclusionary views for constructing a vision for an inclusive mathematics teacher education?*

Chapter Summary

In this chapter I have outlined a number of research agendas (and related research questions) as representing different aspects of the main research problem of culturally decontextualised mathematics education which is embedded in my educational history as a student, mathematics teacher and teacher educator. Exploring my life as a student, I have generated a number of deep-seated questions about the nature of mathematics that has oriented my primary, secondary and university education, thereby legitimating the nature of mathematics as a research theme in my inquiry. Similarly, arising from my master's research and subsequent professional experiences are two key themes of my inquiry: unhelpful dualisms and reductionisms in mathematics education. Subsequently, a research agenda on alternative logics necessary for an inclusive mathematics education has emerged into the foreground of my inquiry space. Reflecting upon my experience of being involved in revising a mathematics curriculum for secondary level education, I formulated a number of research questions related to an agenda for a transformative curriculum vision. My professional engagement in designing a two-year teacher education program at the University of Himalaya has provided me with the research themes of globalisation, foundationalism and a narrow view of mathematical language. More so, I have also established the significance of these agendas to the broader field of mathematics education research by relating them to contemporary issues being explored in the research literature.

CHAPTER 0: PLANNING THE JOURNEY: MEDIATING THE UN/MEDIATED

Introduction

In Chapter -1, I have portrayed my journey of exploring a host of research questions arising from the key research problem of the culturally decontextualised nature of mathematics education in Nepal. This chapter depicts the parallel journey of conceiving a research design for my inquiry into multiple facets of this research problem. In Chapter Zero, I address the notion of multi-paradigmatic design space, thereby articulating research methodologies, quality standards, ethical considerations and an overview of the structure of my thesis. Specifically, the following pointers represent the subsections of this chapter.

- Multi-paradigmatic design space
- Research methodology
- Imagining as epistemic technique
- Theories as referents
- Evidence as cultural construction
- Multiple research logics
- Multiple research genres
- Quality standards
- Ethical obligations
- Formation of Sections and structure of this thesis

Multi-Paradigmatic Design Space

Challenging the reductionist myth of conceiving research design in terms of technical-procedural steps, I began to look at the bigger picture of the nature of knowing in my inquiry. My vision of inquiry considered researchers' life experiences as the primary source of evidence, thereby going beyond the readymade space of the positivist research paradigm as the sole basis for knowledge production in school mathematics education and mathematics education in Nepal. I reviewed a number of views and perspectives about various forms of knowing (i.e., implicit, narrative, poetic, to name a few) This approach gradually led me to the world of research paradigms, comprehensive belief systems and worldviews that offer possibilities of employing a host of logics (i.e., thinking), different methods of representation (i.e., expressing), various ways of legitimating (i.e., standardizing) and multiple research methodologies (i.e., knowing) (Taylor, Settelmaier, & Luitel, in press; Willis, 2007). In what follows, I present my exploration of different research paradigms in terms of their usefulness to my inquiry.

Criticalism

In the process of looking for an appropriate paradigm for addressing my research problem, I started to review the paradigm of criticalism with the aim of examining hegemonic pedagogies arising from culturally decontextualised mathematics education widespread in the landscape of mathematics education in Nepal. At this point in time, I was very much guided by 'outward criticality', a dualistic attitude that perceives the problem to exist exclusively outside of the individual (Taylor, 2008a).

Soon after writing several stories of my experiences, I realised that finger-pointing to the outward world was not sufficient for developing a transformative lens[7] in the inquiry. Thus, I began to look for critical selfhood (i.e., inward or self-reflective criticality) with a view to becoming more conscious of my own possible roles in transforming otherwise hegemonic landscapes of mathematics education. Reviewing the writing of Joe Kincheloe (2006), I came up with a set of helpful perspectives: (i) that critical self-reflection offers an understanding of the significance of socio-cultural and socio-historical process of the

[7] Transformative lens provides researchers with opportunities to expand their distorted narrowness about self and other. The notion of distorted narrowness is taken to represent unhelpful dualism of self versus other that is likely to help me be free from fixed, bounded and essentialised notion of selfhood.

construction of a dynamic self, (ii) that the nature of communication in which the self engages can be useful for changing the structure of reality, (iii) that a self-conscious form of research text helps disembed the self from in/visible ideologies and unidimensional subjectivities (and objectivities, for there is no subjectivities without objectivities, *and vice versa*)

My exploratory journey also suggested that the research paradigm of criticalism was a suitable referent for foregrounding the otherwise unaccounted for research problem of culturally decontextualised mathematics education in Nepal. This research paradigm offered a much-needed critical outlook for excavating the research problem that could hardly be identified via the uni-dimensional lens of positivism. In relation to my research, such an outlook comprises three key elements: a de/colonised view of mathematics education, a non/realist vision of research problem and a transformative concern for the inquiry. A de/colonised view of mathematics education helped me question the givens of mathematics education, such as the hegemony of culturally decontextualised mathematics education, didactic pedagogy and a narrow view of curriculum designing. A non/realist vision of educational research is a radical shift from the exclusive positivistic view of research as discovery of *a priori* ideas to the view of research as critical imagination of futures (Inayatullah, 2008). Similarly, a transformative concern for educational inquiry offered ways to conceive the research problem beyond the invisible frameworks of mathematics education.

I felt that another important contribution of the critical paradigm to my research design was its empowering epistemic metaphors of *knowing as critical self-reflection* (Brookfield, 1994), *cultural and ideological critique* (McLaren & Kincheloe, 2007) and *performance praxis* (Denzin, 2003b). Whilst employing the metaphor of *knowing as critical self-reflection*, I employed primarily my experiences as a student, teacher and teacher educator to portray disempowering forces arising from my various professional roles. For example, I critically reflected upon my roles as a conventional lecturer who masked his own dissatisfaction about the conventional nature of mathematics (see Section One), as a radical teacher educator who could not incorporate practitioners' views of mathematics education (see Section Four), and as a tutor who could not empathise with some of his students' struggles in learning radical ideas in mathematics education (see Section Three). Similarly, the epistemic metaphor of *knowing as cultural and ideological critique* facilitated my critical examination of disempowering cultures (transmissionist, reproductionist, hierarchical, elitist) embedded in extant curricular and pedagogical practices of mathematics education. Similar to the popular Chinese maxim, *opposition is the precondition of change* (xiang-fan-xiang-yin) (Wong, 2006), I employed the epistemic metaphor of ideological critique to question the hegemony of dominant ideologies of mathematics education embedded in: the unidimensional nature of *mathematics as a body of pure knowledge*, exclusive dualistic and reductionist logics, modernist curriculum models, and disempowering views of globalisation, to name a few.

In a similar fashion, the epistemic metaphor of *knowing as performative praxis* represented the embodiment of: (i) being a person who gives due emphasis to an agentive discourse of meaning production; (ii) knowing hyphenated complex constructs, such as self-other, here-there and reality-representation in order to fully understand borderlines by which to generate hybrid meanings; and (iii) valuing diverse possibilities of agentive performativity of students, teachers and other stakeholders through multiple selves and characters. I explain how I used performative imagination as an epistemic technique later in this chapter.

Postmodernism

By constructing multiple selves and characters for representing my plurivocality, I began to realise that multiplicities and differences are embedded in my personal-professional lifeworlds. Consequently, I felt that this aspect of my epistemic journey could not be accounted for solely by the paradigm of criticalism and that I needed to start looking at the possibility of incorporating aspects of the paradigm of postmodernism.

In my mind, defining the paradigm of postmodernism can be a troublesome task because this paradigm is suspicious of grand-narratives, definitions and conceptual categories of any sort (Ernest, 2004). Through this nature of suspicion, however, the postmodern paradigm was an inspiring source for cultivating experimental representations of the process and product of my inquiry. Inspired by artistic and aesthetic sensibilities, such experimental representations have given rise to multiple genres, logics and textualities with an emphasis on multiple ways of knowing (Olson, 2000). In constructing my research texts, the paradigm of postmodern contributed through these features: pluralism and difference, and irony and playfulness (Polkinghorne, 1992). I came to realise that the paradigm of postmodernism promotes epistemic pluralism in which each type of 'knowledge' has the same epistemic status with every other type of knowledge, thereby cultivating differences between individuals, contexts and events. One of the benefits of promoting 'difference' is to challenge the one-size-fits-all formalism of positivism. Another feature of this paradigm, irony and playfulness, was helpful for incorporating paradoxes, absurdities and double meaning interweaving them in my research texts. Unlike the impersonalisation of research texts in the positivist paradigm, the postmodern paradigm celebrates personalised views, thereby promoting creative subversive views about issues under study.

In this journey, I also became aware that an exclusively deconstructive form of postmodernism might not be very helpful for my inquiry. Such a form of postmodernism has been identified with extreme anarchism and endless scepticism which did not seem to fit well with my culminating aim of constructing transformative visions of inclusive mathematics education. More so, I felt that this form of postmodernism could jeopardise my role as a transformative teacher educator who needs to have some beliefs and values (albeit contingently) as a referent for thinking and acting in present and future professional contexts. And thus, the paradigm of postmodernism (with emphasis on constructive postmodernism (Shea, 1998)) served me as a key referent for employing creative methods of knowing through multiple forms of epistemic metaphors, expressions, and logics. This paradigm gave rise to three epistemic metaphors of *knowing as generating transgressive texts* (Guba & Lincoln, 2005), *aesthetic meaning making* (Taylor, 2002) and *semi-fictive imagining* (Clough, 2002).

The epistemic metaphor of *knowing as generating transgressive research texts* provided a basis for cultivating my personalised, soulful, embodied and felt vocality on the issues embedded in my research questions. By transgressing the *it-centric* language of positivism, I was able to account for multiple realities, to use different forms of text to constitute different ways of being (and knowing). Such transgressive texts include stories, performances, poems, visuals and reflective narratives. Similarly, by using the epistemic metaphor of *knowing as aesthetic meaning making*, I was able to explore the otherwise ignored ineffable, ambiguous and implicit dimensions of knowledge embedded in my lifeworld. I used three key means for facilitating the process of aesthetic meaning making: metaphors, images (non-linguistic texts) and poetry. My extensive use of metaphor helped deliterise (i.e., artistically represent) knowledge (Eisner, 2008) by offering vicarious experiences of virtual and elastic comparison and to contrast between seemingly different concepts, thereby expanding the literalist border of concepts, ideas and notions under discussion. More so, I used images as heretical means for aesthetizing the process of knowledge generation by juxtaposing visuals against the text. More so, poetry was used to represent my inner calling of confessions, subversions, initiations, imagination and performances.

I used the epistemic metaphor of *knowing as semi-fictive imagining* as a way of subverting the exclusive emphasis on collection of facts and redressing them through literalised and it-centric language. I hold the view that 'factual' and fictive co-exist side-by-side, for it is hard to make sense of factual without its dependent co-arising fictive (see Section One and Section Two for the notion of dependent co-arising). Given my purpose in constructing visions of inclusive mathematics education, I chose to represent aspects of my knowledge claims through semi-fictive imagination (Clough, 2002). Here, I use the term semi-fictive imagination to radically challenge the positivistic duality of factual versus fictional which is not helpful for an inquiry that aims to use imagination as a key epistemic technique.

Finally, the paradigm of postmodernism facilitated my inquiry as a creative constructive enterprise via the view that aspects of our everyday reality are not pre-given, that they are constructed and reconstructed through our subjective lenses. The emphasis on the context-dependent nature of meaning (knowledge claims) helped me construct imaginings of inclusive mathematics education for Nepal. To so do, the postmodern paradigm enabled me to challenge the absolute privileging of objective over subjective knowledge, thereby facilitating a shift beyond the dualistic logics of positivism with help of different forms of *new* research logics. I explain multiple research logics and genres later in this chapter.

Interpretivism

In the process of constructing and using multiple research genres and logics, I realised that an exclusively fixed, pre-determined research design does not help much in accounting for emergent epistemic activities. Thus, I took yet another detour, this time, to the paradigm of interpretivism in order to be well-informed about the emergent process of writing as inquiry.

I came to understand that interpretivism is a radical response to the uni-dimensionality embedded in the interpretation of phenomena, events or situations under the positivist paradigm (Willis, 2007). As opposed to the positivistic emphasis on literalist description of data through *a priori* and invisible worldviews, central to interpretivism are cultural, hermeneutic, phenomenological and aesthetic sensibilities that help construct contextual meanings of events or phenomena under inquiry. Responding radically against the fixed and deterministic structural approach to design, the interpretive paradigm helped me to take an open-ended path of inquiry whereby I came up with emergent research questions and structure of my inquiry.

I used three key elements of interpretivism to construct my research design space. First, my inquiry subscribed to an emergent mode of inquiry in which sections, chapters, topics and research questions emerged and crystallised as the inquiry progressed (Taylor, 2008b). My Sections (of the thesis) were developed through themes arising from reflective exploration of my lifeworlds as a student, teacher and teacher educator. My research questions have a history as they continued to evolve in the process of writing about my experiences of playing different professional and personal life-roles in various contexts.

Second, whilst employing the paradigm of interpretivism, I was able to develop a host of interpretive perspectives (Wolcott, 2001) which served as a basis for examining issues about the nature of mathematics, unhelpful dualisms, prevailing reductionism in mathematics education, and additional inclusive (i.e., *new*) logics, to name a few. Expressed via my stories, poems, reflections and visuals, these perspectives were helpful for generating personalised, contextual and inter/subjective meaning of issues arising from the research questions.

The third contribution of the interpretive paradigm to my inquiry was of ontological, epistemological and axiological kinds. Aspects of my ontology are relativistic without which contextual meaning making turns out to be a difficult endeavour. More so, relativistic ontologies help conceive reality as socio-cultural construction, thereby giving rise to a multi-perspectival view of reality (Pereira, 2007; Wolcott, 1999). Nevertheless, I also remained constantly aware of the limitations of relativistic ontologies in relation to upholding certain universal moral values. Thus, relativism is an aspect of my multi-paradigmatic research design which employed a holistic and multidimensional view of reality. Epistemologically, interpretivism gave rise to two key epistemic metaphors so as to guide my research journey: *knowing as interpreting* and *constructing* (Luitel et al., 2009). These metaphors helped me develop multiple perspectives about issues associated with my inquiry. A key characteristic of these epistemic metaphors is to employ literal, metaphorical and poetic dimensions of language. I discuss these notions under the section of research logics and research genres later in this chapter.

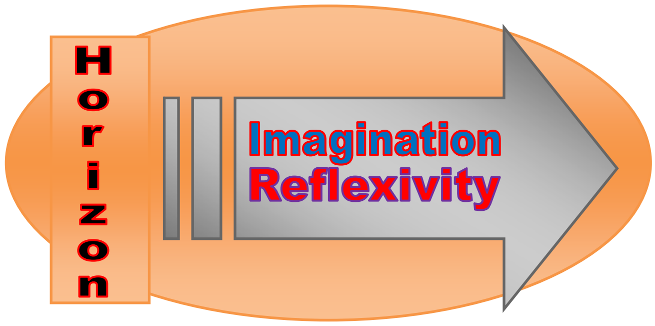
Integralism

Having the paradigms of criticalism, postmodernism and interpretivism at my disposal, I constructed stories and interpreted them from my experiential and theoretical standpoints. So what? Indeed, such epistemic activities did not seem to represent the complete goal of my inquiry, which was to explore possible alternatives to the problem of culturally decontextualised mathematics education widespread in the educational landscape of Nepal. With this reminder, I felt that I needed somewhat holistic thinking (not 'grandiose' though) in my research design so that I could construct visions about solving the problem of culturally decontextualised mathematics education faced by Nepali students. Arriving at this stage, I felt that a better vision required holism, humility, synergy and envisioning, which appear to be the salient features of integralism (Wilber, 2000c, 2007).

Considering the paradigm of integralism as a meta-theory for multi-paradigmatic research design space (Taylor et al., in press), I employed the feature of holism imbued in relational, interdependent, co-arising modes of thinking. Reviewing Aurobindo and Wilber (Sri Aurobindo & McDermott, 2005; Wilber, 2000c), I came to know that the whole is more than the sum of its parts. In my research, this feature of integralism was helpful for conceiving an inclusive perspective of knowledge generation, especially in relation to considering sometimes opposing viewpoints about issues arising from my research questions. In this process, I used the epistemic metaphors of *knowing as reconceptualising self* and *holistic meaning making*. By using the metaphor of *knowing as reconceptualising self*, I explored different forms of self from within my experiences, namely, confessing, critical, uncertain, certain, relative and futuristic. Unlike the positivistic agenda that promotes a reductionist view of self as fixed and invisible, the holistic orientation of integralism promotes holistic meaning making of self that visibly co-lives, co-acts and co-performs (Kegan, 2002; Wilber, 2000a).

Another key feature of integralism that I used in this inquiry is synergy. The idea of synergy is cooperative interactions among sometimes adversarial, seemingly different attributes leading to an enhanced combined outcomes (Gidley, 2007b). In my research design, features of synergy were applied in many possible ways. For example, I subscribed to sometimes opposing ways of knowing, such as ideology critique <u>and</u> construction as well as performance praxis <u>and</u> connotative explanation (i.e., interpretation), so as to generate multi-dimensional understanding of issues under consideration. Next, whilst critiquing any forms of exclusivity, I chose a middle way to articulate my research process and product. I envisaged that such a middle way provides a semi-open space for synergistic creativity between adversaries and differences embedded in the process of exploring problems, interpreting issues embedded in them and offering possible solutions to those problems.

Another important feature arising from integralism that contributed to my research design is humility. The idea of humility helped me to be less presumptive about contentious issues and to demonstrate a commitment to self-evaluation, self critique and acceptance of self-weaknesses (Ho, 1995; Massoudi, 2002). I tried to employ this in my research through dialectical logic, a thinking model that promotes inclusive AND thinking as opposed to absolutist dualistic OR thinking. It is through dialectical logic that I tried to stay away from dogmatic claims that often promote the arrogance of knowing everything. Consequently, whilst constructing perspectival envisioning based on the issues and problems under study, I employed humility in the sense that I tried to suspend absolutism whilst constructing visions. I explain humility later in the chapter in relation to its contribution to the quality standards of my research.



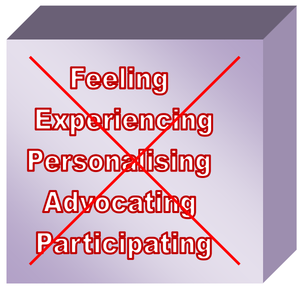
Together with humility-oriented dialectical logic, the integral paradigm offered me the empowering epistemic metaphor of *knowing as envisioning*. I used the notion of envisioning as a synergistic synthesis (but not exclusive of analysis) of formal (i.e., hypothetico-deductive, one-size-fits-all, analytical-deductive-propositional) and post-formal thinking with a view to speaking about future possibilities. Such envisionings are not meant to be full and final but to be constitutive of voluntary imaginative errors as occur in every human imaginative endeavour. Thus, key aspects of the envisioning in my research are constitutive of inclusive logics and expressions, various forms of imagination and perspectival language.

After conceiving such a multi-paradigmatic design space, my initial research questions widened with an added emphasis on the role of envisioning for addressing research problems and issues. In order to facilitate the process of envisioning, I felt that I needed integralism with an emphasis on holism, synergy and humility. This research paradigm brought a number of ideas from Eastern Wisdom traditions to my design space, including Vedic and Buddhist dialectics (see, Section One), a nondual view of reality (Gergen, 1995; Loy, 1997), a post/essentialist[8] view of language (Colledge, Dalton, & Strobbe, 2002), metaphors and poetics, to name a few.

[8] Post/essentialism is a shift from the view that language has always an essential meaning to language has context-dependent meaning.

Positivism

After conceiving integralism as the rationale for the much needed multi-paradigmatic space, I soon realised that I also was using three features of the positivist research paradigm, in particular propositional logic, metaphysics of presence, and a degree of control over my research project (Kincheloe & Tobin, 2009; Laudan, 1996). I might have rejected positivism on the pretext that these minor ‘elements’ were not highly effectual in my research. Positivism has long been considered (at least philosophically) to be the mainstream paradigm of educational research. This paradigm can be characterised by its emphasis on pre-determined research design, objective knowing (in which the role of the researcher is conceived to be detached from the context of the research), quality standards of validity and reliability, and a one-size-fits-all (formal, hypothetico-deductive logic) thinking model. Critics of this paradigm accuse it for being unidimensional in terms of knowledge production as well as for privileging a technical rationalist view of educational research. As far as the research representation is concerned, adherents of this paradigm promote a decontextualised, impersonal and exclusively propositional genre, thereby dismissing contextualised, arts-based, personalised genres of research representation.



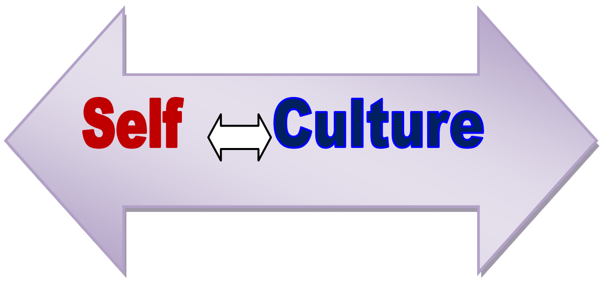
However, I recognised that the usefulness of these features of positivism depend upon the purpose and context of a research study. Many of these assumptions did not serve the purpose of my research. For example, I did not find it useful to say that the knowledge generation process is wholly objective or subjective. Nevertheless, I recognised that some aspects of positivism orient my research, and furthermore that the total rejection of positivism was not possible because of its widespread primacy in the spheres of teaching and research. As far as I am aware, I used three key features of positivism in my research design. First, although I tried to stay away from the dualistic language games embedded in positivism (i.e., objectivism versus subjectivism, realism versus nominalism, and determinism versus voluntarism, to name a few), I felt that it was not fully possible to do so because of the widespread hegemony of positivism. Second, I used some aspects of hypothetico-deductive logic (especially in organising and concluding sections) in articulating my ideas. Third, although I exercised a high degree of emergent research design, some aspects of external control were present as a result of getting the approval of relevant committees of the university.

Research Methodology

Informed by a multi-paradigmatic design space, I chose a hybrid research methodology constructed through two methodological referents – auto-ethnography and 'small p' philosophical inquiry. In what follows, I present my journey of exploring their uses in my inquiry.

Autoethnography

I used autoethnography as aspects of methodology, method and genre of my inquiry. I used autoethnography as an insider's methodology in which my personal and professional experiences became the key basis of this inquiry. Etymologically, the term autoethnography comprises three different words –*auto, ethno* and *graphy* – which signify the textual representations of one's personal experiences in his/her cultural context. In my research, auto-ethnography demonstrates a radical departure from the positivist notion that social reality is out there and ready to be discovered by a neutral researcher. Thus an autoethnographic methodology subscribes to the view that reality is constructed through the depiction of the researcher's experiences in a cultural context (Spry, 2001, 2006). Consequently, this methodology promotes transgressive ways of knowing such as interpreting, self-reflection, deconstructing and evocative storying, all of which seem to arise mainly from interpretivism, criticalism and postmodernism (Ellis, 2004). A significant aspect of my research has been guided by an autoethnographic methodology with the use of my experiences as a student, mathematics teacher and teacher educator in Nepal, and that subscribes to arts-based methods of inquiry so as to account for issues, questions and agendas that are otherwise unaccounted for by narrowly conceived scientific research methodology.



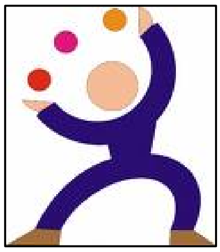
Conceived as a self-culture dialectical space, I have used autoethnography as a method in many possible ways. I call this a dialectical space because the relationship between self and other is co-arising, reflexive and embodied, meaning that without self culture does not make sense fully, so as to reveal all its possibilities. Primarily, I have employed the method of writing as inquiry so as to unpack, explore and interpret research issues that have arisen from my situatedness in cultural-professional contexts (Richardson & St Pierre, 2005). In my research, writing is constitutive of the process of inquiry, rather than being an add-on activity performed on completion of the inquiry, and gives rise to an emergent research design not dissimilar to investigative journalism or novel writing. More so, autoethnography as a method has been useful for cultivating creative and layered understandings of issues under my inquiry. Finally, it facilitated me to employ arts-based methods of inquiry (e.g., Barone & Eisner, 2006) by departing from the dualistic notion of data collection to an inclusive notion of data generation which I explain later in the chapter.

In this inquiry, I used three key features of autoethnographic text: performative, dialogic, and pedagogic enablement. The performative feature of my autoethnographic text helped me construct narratives of my experiences of professional-cultural situatedness. In my inquiry performative texts do not simply offer explanatory information but invite readers to imaginatively and creatively perform my texts in various possible ways (e.g., by reading stories and narrative out loud, by creating a reader’s theatre, by identifying with a character of the story, by involving body and mind in reading) (Donmoyer & Donmoyer, 2008; Pelias, 2008; Saldaña, 2005, 2008). Whilst addressing the dialogic feature of autoethnographic text, I constructed evocative and interactive stories of my experiences, thereby offering spaces for readers to reflect upon their deep-seated pedagogic (and otherwise) values and beliefs (Bakhtin, 1981). More so, aspects of my inquiry process use perspectival language as a basis for promoting dialogue between readers and me. Such language-embedded texts are likely to engage readers in imagining themselves in one or many possibilities offered by my research texts.

Similarly, I had hoped to inculcate pedagogical enablement (e.g., Pennington, 2007) through my autoethnographic texts by (i) constructing stories that foreground otherwise marginal issues of mathematics teaching and learning, (ii) de/colonising the exclusivity of realist representational style in textual construction and presentation, and (iii) demonstrating ways of articulating the importance of emancipatory social solidarity in conceiving transformative pedagogical practices in mathematics education. I use the term 'marginal' because these stories may contradict the formalistic ethos of the grand-narratives of mathematics pedagogy widespread in Nepali mathematics education. By subscribing to an arts-based representational mode, I aim to decolonise the conventional chapter structure.

Small p philosophical Inquiry

I present this methodological label as my own construction on the basis of my readings of different philosophical traditions. I envisage that small p philosophical inquiry complements auto-ethnography via the epistemic metaphor of *knowing as envisioning*. Tracing back to the Greek traditions, I found empowering insights into the notion of philosophy as a source of wisdoms (Guthrie, 2003). Does not this mean that philosophy is more than factual knowledge? Aristotle has been quoted for his emphasis on practical knowing as a key basis for wisdom. More so, the term *darśana* is taken to represent the philosophical aspect of Vedic and other 'Sanskrit' traditions. The words sight (e.g., seeing) and vision can describe possible meanings of darśana in English (Prime, 2002). Upanishads talk about the power of vision for transforming our mortal bodies to immortal cosmic Self. Although Upanishads suggest a number of methods for realising such transformatory visions, I came to know that personal-experiential seeking appears to be a common element in different methods. Central to such seeking, according to Mandukya Upanishad, is an attitude to go beyond the limitation of everyday eventuality (i.e., Maya, the illusive reality) (Nikhilananda, 2008).



In this way, personal practical knowing and personal-experiential seeking were key orientating bases for my small p philosophical inquiry. As a personal practical knower my focus was on making better sense of my practice, whereas as a personal-experiential seeker I tried to be more than just a sensemaker: I strived to develop visions of possibilities. I chose small p philosophical inquiry to distinguish it from (capital P) Philosophical Inquiry[9] which seems to privilege absolute Idea (and Theoretical View of Rationality (Rorty, 1982)) over personal-experiential ideas arising from my personal and professional lifeworlds. More so, capital P Philosophical Inquiry seemed likely to take over my agency as a researcher via its normative tendencies of privileging theoretical over experiential, thereby aiming to generate universal theories (Rorty, 1982). Coming to know that the key source of research questions under Philosophical Inquiry is the web of Ideas, I envisaged that small p philosophical inquiry used my lived experiences whilst generating research questions for this inquiry (Greene, 1997)[10]. Nevertheless, this does not mean that small p philosophical inquiry is dismissive of capital P Philosophies (or capital T Theories), rather it is likely to make a non/dualistic (i.e., inclusive of nondualistic and helpful dualistic categories) shift from a dualistic imposition of capital P Philosophies over practitioners' local wisdoms and ideas. Here, the non/dualistic shift entails an inclusive positionality in which ideas and Idea and practices and Philosophies are in reflexive and dialectical relationships.

As a methodology, I envisaged that small p philosophical inquiry was guided mainly by the culminating epistemic metaphor of *knowing as envisioning*, a constellation of multiple ways of knowing, such as *deconstructing*, *constructing*, *re-conceptualising* and *imagining*. In this methodology, I did NOT subscribe to either subjectivist or objectivist notions of knowledge (Cohen, Manion, & Morrison, 2001), for both exist side-by-side in dialectical relationships[11]. Similarly, I envisaged the ontology of small p

[9] Generally Philosophical Inquiry is considered to be analytical and theoretical analysis sans experiential evidence. More so it is also regarded as an analytical pursuit where the notion of analytic is conceived to promote dualities of reason versus evidence, rational versus practical, Ideas versus ideas, to name a few (Feinberg, 2005).
[10] I quote Maxine Greene for small p philosophical inquiry because she argues for the primacy of the researcher's experiences over absolute philosophical foretelling.

[11] Rorty argues that dualistic thinking does not help us to make best possible use of philosophies to cultivate imagination about vexing issues of our lives; indeed, the dualistic categories are contingent and we can use them for perusing our arguments in context (Rorty, 1989).

philosophical inquiry to transcend the realist versus nominalist dualism, for both labels are restrictive in relation to my purpose of developing a vision of inclusive mathematics teacher education. I conceived of small p philosophical inquiry to abide by the holism, synergy and humility of integralism. Whereas holism helped me be inclusive of competing interests and ideologies, synergy offered ways to create new perspective through meaningful mixes of differences. I used humility as an approach to remain less presumptive whilst (small p) philosophising my own experiences.

As a method, I employed small p philosophical inquiry to construct transformative visions of mathematics education. With the method of *writing as inquiry*, I attempted to construct what Whitehead (2009) calls 'living educational theories' (philosophies) to be useful for my present and future professional lifeworlds. More so, through the method of small p philosophical inquiry, I employed philosophies (together with my experiences) as a basis for imaginative perspectives rather than knowledge claims of an absolute nature. This Rortian view of philosophy (e.g., Malachowski & Rorty, 1990; Niznik & Sanders, 1996; Rorty, 1991) enabled me to employ the metaphor of *knowing as envisioning* through two epistemic techniques: narrative and performative imagination which I explain later in the chapter.

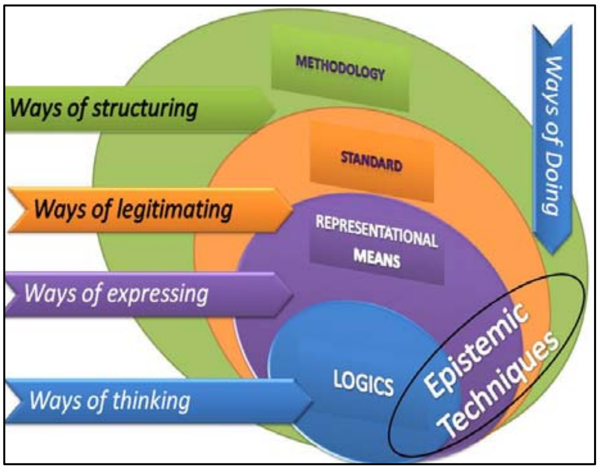
As far as the textual aspect of small p philosophical inquiry is concerned, I brought un/certainties to the foreground of my writing. Unlike capital P Philosophical Inquiry which tends to establish certainty by privileging Rational Ideas over a-rational practices, I employed small p philosophical inquiry to bring forth the un/certain nature of my professional domain as a mathematics teacher and teacher educator (Jardine, 1998)[12]. Whereas capital P Philosophical Inquiry seems to put emphasis on singular logic (i.e., arising from hypothetico-deductive thinking) in creating research

[12] David Jardine talks about boundlessness to articulate the notion of un/certainty. Indeed it can be un/certainty that helps bring forth humility in the pursuit of imagination (Jardine, 2005).

text, I used small p philosophical inquiry to promote multiple and perspectival thinking through propositional, metaphorical, poetic and dialectical logics.

In a nutshell, small p philosophical inquiry helped me generate a radical response to (capital P) Philosophical Inquiry which privileges Ideas over experiences (Dewey, 1997). Here, Idea is regarded as an unchanging, being-in-itself static object, thereby promoting the reified 'noun' aspect of knowledge. On the contrary, I envisaged small p philosophical inquiry as promoting the verb aspect of knowledge, thereby upholding a view of knowing for personal empowerment. Such personal empowerment can be possible by subscribing to the notion of human nature as being-for-itself or the being of possibilities. Whereas chairs, tables and other material objects are being-in-itself, humans are seekers for visions of growth, expansion and transformation (Greene, 1995, 1997). It is my contention that seeking such visions is constitutive of our everyday lifeworlds. In my research the act of vision-making was performed mainly through two epistemic techniques: narrative and performative imagination.

Imagining as Epistemic Technique



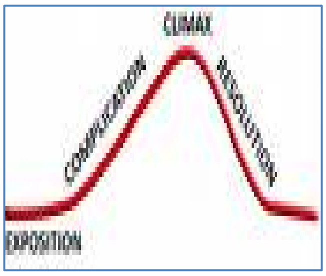
An epistemic technique refers to ways of 'doing' inquiry at the technical and technological level. Similar to the Foucauldian idea of epistemic technique as a collective (and sometime unconscious) expression of logic, methodology and language, and a 'technology of truth' (Danaher, Schirato, & Webb, 2000), I (tentatively) positioned epistemic technique as a modus operandi of my inquiry that overlaps logics, representational means, standards and methodologies of my research. More so, I employed the epistemic technique of imagining with a view to exploring possibilities about inclusive mathematics education in Nepal. Unlike a positivistic epistemology of probing (and proving), the epistemic technique of imagination (and envisioning) (Henderson & Kesson, 2004) strives to generate knowledge about utopia, fantasy, dreams, visions and intentions (Greene, 1995).

Unsurprisingly, these forms of knowledge and knowing appear to be unaccounted for by inquiries that often regard the notion of research as exclusively descriptive via a disembodied genre which is believed to have filtered out 'nonactual' and 'unreal' realities (Green, 1985). However, such an epistemic technique surpasses the technical and procedural purpose of knowing based on naïve realism, thereby bringing the emotional, soulful, utopic and aesthetic flesh to the skeleton of my inquiry.

Narrative imagination

Narrative imagination was useful for telling my contextual tales inextricably related to people, places, times and events, thereby helping readers to generate meanings and

understatings about the pedagogical realities that are depicted through my texts. Often considered as retrospective meaning making, narrative imagination is constitutive of stories, theatrical texts, paintings and oral performances as both the process and product of the inquiry (Chase, 2005). Following through this epistemic technique, I depicted my role as a teacher educator and teacher as a protagonist, a reflective thinker and a confessing person so as to bring the uniqueness of my cultural and pedagogical situatedness to the foreground of my storied texts. Furthermore, my use of narrative imagining was intended to account for different types of vocality, such as entertaining, informing, defending, explaining, complaining, confirming and challenging. In this spectrum of possible vocalities, my stories of experience used different textures so as to explore various features of conventional and alternative logics. Needless to say, the primary audience of my narratives is Nepali mathematics teachers and teacher educators. This does not mean that my narratives cannot be empathised with by teachers and teacher educators from contexts similar to that of mine.

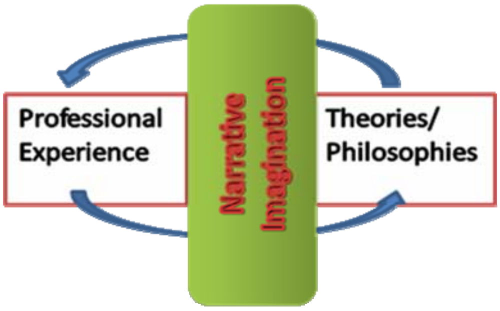


In my research, I employed the epistemic technique of narrative imagination in four ways. Firstly, I grounded my narratives in my professional roles as teacher and teacher educator to construct contextual meanings of my pedagogical practices. For example, my narratives unpacked unhelpful dualisms widespread in my professional contexts (see Section Two), questioned the status-quo of conventional logics (see

Section Four), disrupted the hegemony of modernist curriculum models (see Section Five), and intended to transform the pedagogical landscape of mathematics education. Secondly, my narrative imagination was guided by moral obligations (Hale, Snow-Gerono, & Morales, 2008) without which the process and product of my imagination could not address the problem of the perverse exclusion of local cultural practices from school mathematics. Subscribing to the primacy of moral obligations I did not necessarily reduce my narrative imagination to a prescription, rather I invited readers to gauge my vision embedded in my stories, poems, and reflective-interpretive genres. However, my imagination woven in stories, poems and interpretive text was not a purposeless fantasy; rather it was driven by my passion for and goal of transforming mathematics education that accounts for the diverse cultural landscapes of the Nepali people.

Next, my narrative imagination aligns with the idea of going back to a primordial state in which the subject-object dichotomy appears to cease, and the body, mind and heart unite to make sense of self in context. As Greene (1985) brings forth Merleau-Ponty's idea of imagination as tracing back to one's self rather than exclusively programming a dualistic notion of imagination without self, I attempted to bring forth texts with passion, empathy, tenderness and aesthetics in an effort to see through myself artfully in context (Barone, 2006). Thus, an important aspect of my narrative imagination was to promote self-expression rather than avoidance of self. Furthermore, by refraining from using an extreme form of 'conception' and 'conceptualising' that often distanciates the knower from the known, my narrative imagination was grounded in a non/dualistic view of the world (Loy, 1997). Therefore, my stories, poems and interpretive texts attempted to celebrate the primacy of perception (not rejecting the value of conception) as a means for generating a multi-perspectival view of reality. Finally, my purpose through this epistemic technique was not about presenting an error-free, perfect and unquestionable imagination. My narrative imagination helped combine fiction (not necessarily rejecting facts), playfulness, reflexivity, dreams (Gilmer, 2004; Williams, 1996) and more or less voluntary errors. Through this process, my narratives cultivated imaginings by viewing my assumptions, actions and situatedness as if they could be otherwise (Greene, 1995). Avoiding an exclusive form of positivist-inspired literalism that promotes a narrow view of text, meaning and sense-making, I embraced inexhaustibleness so as to invite multi-textual collage as a means for capturing possibilities.

In my research, the epistemic technique proceeds through four successive stages. The first step constituted constructing stories via one or more critical moments of my professional life. The selection of such critical moments was based on research agendas or questions as some of them emerge in the process of inquiry. Such stories came to being through composite plots and characters depicting complexity embedded in my professional situatedness. Indeed the very process of constructing composite stories required imaginative creativities to make them sound believable. In the second stage, I interpreted problems and issues embedded in the story through personalised-reflective narratives. In the third step, I employed theories and perspectives from literature to interact with issues arising from my reflective interpretation. This interactivity could not be simply conceived as matching between my ideas and theoretical constructs, rather it is complex, hybrid, iterative and multidimensional imaginings. In the final stage, I came up with possible visions for addressing issues or problems embedded in the research questions. Such visions can be regarded as the synergy between imagination and reflexivity.



Performative imagination

Arising from the field of performance ethnography, performative inquiry, theatre and poststructural discourses, the epistemic technique of performative imagination can be articulated well by clarifying the notions of performance, performative, and performativity. In my research, the idea of performance served as an explanatory metaphor for knowing *in*, *for*, and *by* context whereby the notion of performative challenges the positivist idea of separating between writing and acting (Alexander, 2005). Thus, the epistemic technique of performative imagination requires the direct involvement of the researcher; it cannot be undertaken from a detached observational posture (Pelias, 2008). The idea of performativity as

"reiterative power of discourse to produce the phenomena that it regulates and constrains" (Butler, 1993, p. 2) helps embrace a praxis-oriented view to imagine repetitive human activities. These meanings of performance, performative and performativity let me discuss how the epistemic technique of performative imagination has facilitated my inquiry.

Primarily, the epistemic technique of *performative imagination* helped me generate multiple selves and characters[13] arising from my experience as a student, teacher and teacher educator. Such selves and characters speak through various frames of situatedness and standpoints, at times taking both divergent and convergent pathways of enactment of their ethnographic moments. Unlike the research situated within the positivistic paradigm, in which convergence and confirmation is warranted and reported, performative imagination is a technique for unpacking differing viewpoints, yet having the intention to forge an agreeable consensus between competing interests of selves and characters. In this research, these selves and characters were constitutive of my professional contexts: they were indeed part of my being and becoming. Echoing the Habermasian notion of speech as an act of consensus building (Habermas, 1972), performative imagination helps create a stage or stages in which to en/act dialogues, mediation, conflicts, renderings and reiteration. In my thesis, performative imagination represents both process and product, at times blurring the relationship between the two, as the demarcation between the performer and the performed, speech and spoken and performance and performativity gets faded out. One of the hallmarks of such a situation, according to Pelias (2008), is putting texts into cultural motion, thereby cultivating multiple ways of imagining about the phenomenon being investigated.

[13] I have used these two terms, *selves* and *characters* as separate concepts – selves, representing multiplicities within our embodiment; characters, portraying multiplicities arising from outside of us.

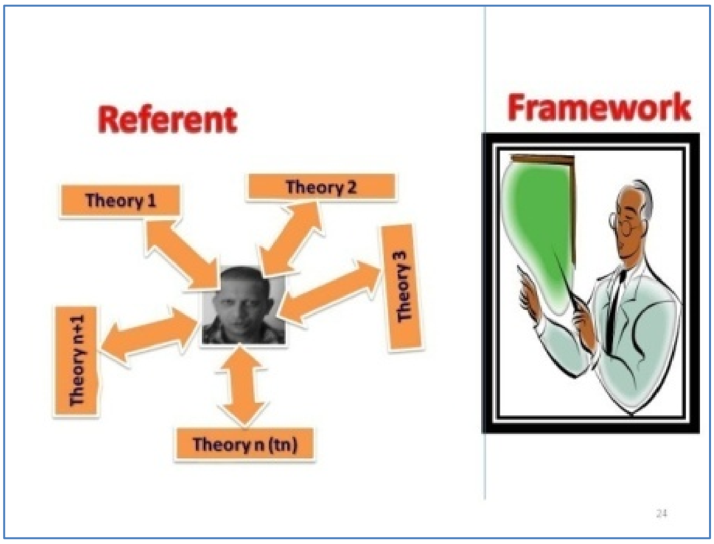
With the help of multiple research logics and genres (see below), the epistemic technique of performative imagination was aligned with the methodology auto-ethnography, an *autoperformativity* that regards self as a resistant and transformative force (Alexander, 2005). Challenging the given, a-priori and pre-existing notion of self as an inherently homogenous, unitary, singular and pure entity, my use of multiple selves was linked with the idea of cultivating 'other' with/in me via dialectical logic, a thinking strategy that unites opposites as a means for synergy and change (Wong, 2006). Hopefully, my performative texts offer an example of how performativity resides with/in us as a means for cultivating new 'meaning regimes' of issues under investigation occurring in my cultural situatedness (e.g., nature of mathematics, reductionism, globalisation, to name a few). Therefore, the purpose of my performativity has not been to generate universal meanings of anything, rather it was to develop contextual envisioning of transformative and meaningful mathematics education.

As an epistemic technique, performative imagination progressed (tentatively) through the following steps. In the first step, research agendas or questions and my nodal professional experiences became the basis for constructing the scripts, characters and acts. This process of imagining a plot or plots for a performance play progressed through an iterative and emergent process that was constitutive of writing as inquiry. In the second stage, key research problems or questions were further articulated in initial *acts* via storied and reflective genres which portray various aspects of research questions being investigated. In the third stage, successive *acts* present my reflective interpretation of themes, issues and dilemmas associated with research questions, thereby presenting possible visions about addressing problems and issues embedded in research questions. Although my professional experiences played a key role in developing meaningful and creative imaginings for conceiving an inclusive mathematics education, relevant perspectives and theories were also influential across the three steps.

Theories as Referents

I realised that theories (e.g., philosophies, paradigms, perspectives, ideologies, standpoints, Other-generated views) are just as important as my experiences as a student, teacher and teacher educator to facilitate an inquiry with an emergent, multi-perspectival and holistic nature. In the conventional research situated in the paradigm of positivism, theories are treated as the sole basis for identifying a research problem as if personal professional contexts of the researcher are not a matter of research consideration. More so, such a research paradigm treats theories as a framework, an invisible epistemic structure that shapes the process and outcomes of one's research.

Therefore, I attempted to stay away from such a disempowering notion of theories as frameworks, instead employing the creative notion of theories as referents (Tobin & Tippins, 1993). Here, the idea of referent is associated with pluralistic interpretations of a theory, with the much needed visibility as a key basis for liberating me from the possible enslavement of theory or theories under consideration. Whilst treating theories as referents, I attempted to make use of their conceptual, critical reflective and imaginative meanings, thereby giving primacy to hermeneutic (and transactional) use of theories over their monological use as frameworks (Slattery, Krasny, & O'Malley, 2007).



Conceptual meaning (also analytical meaning (Egan, 1997)) of theories enabled me to identify their tenets, premises and underlying assumptions. Conceptual meaning of theories may be necessary but is insufficient for making the researcher aware of their boundary conditions. As a result, with the help of critical and reflective meaning of theories, I hoped to maintain my integrity as a researcher who tries not to be enslaved by the ideational landscape of theories. Such a critical dimension helped me to remain aware of the potential hegemony of any theoretical standpoint over my experiential perspectives (and vice versa). In other words, critical-reflective meaning of theories (Down & Hogan, 2000) helped me not to privilege capital T Theories over small t theorising (or small p philosophising), a basis upon which to make better sense of my professional practices as a teacher and teacher educator.

Finally, I envisaged an imaginative meaning-making of theories to be yet another feature of theories as referents in my inquiry. Such a meaning making of theories goes beyond the dos and don'ts of conceptual interpretation of theories, thereby using them as an ingredient (together with many other ingredients) for cultivating various forms of imaginings, such as pedagogical, curricular, cultural and political (Leonard & Willis, 2008).

Evidence as Cultural Construction

I employed an inclusive and empowering view of evidence-based inquiry. Thus far, evidence-based knowing has been locked in the positivistic view of evidence as entities, events, phenomena and incidents existing 'out there' (Spry, 2009). Such a view of evidence may be necessary for generating descriptions of the *what*, *when* and *how* of events and phenomena under consideration. Nevertheless, I realised that this 'out there' view of evidence was insufficient to investigate research problems that are inextricably associated with the personal and professional experiences of a practitioner. Thus I employed a non/dual view of evidence as (socio-) culturally constructed (and situated) events, phenomena and moments as an inclusive alternative to the positivistic view of evidence (Ellis, 2004).

The primary evidence arose from my experiences as a student, teacher and teacher educator. Excavation of critical moments of my life helped me to generate evidence of the various hegemonic practices of decontextualised mathematics education widespread in the educational landscape of Nepal. The positivistic language game of data collection did not work for me as it excludes the process of evidencing through generating data from within my experiential worlds. This is not to say that I am dismissive of data collection, rather I am critical of its hegemonic posture that evidence should exist outside, uninfected from the subjectivities (sic) of the researcher[14] (Lassonde, Galman, & Kosnik, 2009; Whitehead, 2004). Indeed, the metaphor of data generation is more empowering and inclusive because generating is possible from *within* (the researcher's direct experiences; similar to Polyani's (1998) concept of dwelling in) and *without* (through others, outside of the researcher's direct experience)[15].

The second source of evidence entailed a host of perspectives arising from Others, that is, researchers generating different perspectives, theories and ideologies. I aimed to employ these evidentiary Others as a basis for perspectival meaning generation of the issues and problems under study. More so, I was aware of the danger of the hegemony of evidentiary Others in my inquiry. I hoped to overcome this danger via a self-conscious form of writing informed by the research standard of critical reflexivity. I envisaged that creative use of evidentiary Others as referents would help to keep possible hegemonies at arm's length.

These two evidentiary sources were related to each other in many possible ways. For example, evidences arising from my experience helped identify evidentiary Others as well as evidentiary Others helping to generate evidences in my experiential landscapes. This two-way relationship offered many permutations between seemingly contradictory sources, thereby creating a hybrid space of perspectival knowledge claims. Having these evidentiary sources at my disposal, I hoped to resolve (to some extent) the duality of data versus theory because this duality is less likely to promote the non/dual view of non-difference between the researcher (myself) and the researched (my own experiences as different professional roles).

Multiple Research Logics

I envisaged five different research logics enriching my multi-paradigmatic inquiry into the problem of culturally decontextualised mathematics education faced by

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[14] I hold the view that even if a researcher wants to communicate well about 'objective knowledge'; her/his subjectivity comes to the forefront.

[15] Indeed this category of *within* and *without* is somewhat unclear. I admit that such a language of dichotomy is problematic.

Nepali students and teachers. These research logics represent a host of thinking models orienting different ways of knowing. For example, dialogical logic is useful to conceive knowing as holistic interpretation. In what follows, I briefly discuss how I employed different research logics in my inquiry.

a) Hypothetico-deductive logic: The classical hypothetico-deductive logic of the positivist research paradigm comprises three powerful but restrictive logics, namely, propositional, deductive and analytical (Laudan, 1996; Luitel et al., 2009; Chapter Zero). Given the longstanding hegemony of propositional-deductive logic in knowledge generation, I used a 'mild' form of it to set the scene for my sections and chapters. Although I am critical of the dualistic emphasis of analytical logic (i.e., analysis), I used some aspects of it whilst exploring phenomena, issues and themes through their classificatory 'or else' categories. Whilst being critical of the exclusive reductionist emphasis of hypothetico-deductive logic, I could not escape fully from some aspects of reductionism, especially when making conclusions about my knowledge claims arising from my inquiry.

b) Dialectical logic: The main purpose of dialectical logic is to minimise contradictions imbued in 'either or' dualistic logics by promoting synergistic and complementary views (Wong, 2006). This research logic helped me to transcend dualistic and exclusive thinking via more holistic and inclusive thinking. In my research, dialectical logic played a key role in (a) conceiving a multi-paradigmatic design space, (b) developing a heightened consciousness about controversial and paradoxical issues under study, and (c) facilitating the process of constructing inclusive visions to address problems and issues embedded in the research questions and problems.

c) Metaphorical logic: Metaphorical logic enabled me to engage in multi-schema envisioning, using elastic correspondence between conflicting schemas, in order to capture the complexity of a phenomenon (Lakoff & Johnson, 1980). I employed multiple epistemic metaphors to depict the complex and hybrid nature of my inquiry. Metaphorical logic was used also to explore meaning of concepts and ideas otherwise hidden in the narrowness of literalism. This logic offered a platform for thinking and acting through perspectival 'as-thoughs' in order to minimise an extreme essentialism embedded in the positivistic research tradition. Here, essentialism is associated with narrow literalism that regards words and sentences as un-alterable objects (Cupane, 2007).

d) Poetic logic: In my research, poetic logic became a basis for exploring nonreal, felt, mythical, perceptual, imagistic and atypical realities otherwise neglected by hypothetico-deductive logic, thereby disrupting the stereotypical view about research as producing *real* (not *nonreal*), clean (non messy) and unequivocal texts. More so, this form of logic helped me re-enact nonlinearity, emergence, melody and meter which are helpful aids for exploring imaginative possibilities (Leggo, 2004).

e) Narrative logic: In my research, narrative logic was an important means for thinking through multiple dimensions of lifeworlds (Clandinin & Connelly, 1998). Unlike the logos-inspired thinking embedded in hypothetico-deductive logic, narrative logic promotes mythos-centric thinking, an approach to accounting for cultural-contextual knowing, being and valuing (David, 2006). More so, narrative logic was helpful for promoting post/reductionist thinking that transcends the hegemony of reductionism by integrating place, people, action and time in generating research texts. Importantly, narrative logic offered a diachronic vision, a means for conceiving research process in terms of the chronological evolution of events, research foci and emergent questions. In my research diachronic vision helped make my narratives intelligible in terms of bygone and transpired moments of my inquiry.

Multiple Research Genres

Having articulated the inclusive and synergistic emphasis of multiple research logics, I now explore multiple research genres that were useful for representing knowledge generation undertaken according to my multi-paradigmatic research design. I argue here that the impersonal genre of positivism would not help me to fully represent multifaceted experiences of culturally decontextualised mathematics education. Therefore, with a view to undertaking the multi-paradigmatic inquiry as per its spirit, I explored five key genres that enabled me to articulate the multi-paradigmatic design space.

(a) Reflective-interpretive genres: These genres can be defined as a representational basis for personal and perspectival knowledge claims. In my research, reflective-interpretive genres were useful for: (i) maintaining researcher's presence in research texts, and (ii) constructing self-conscious and polyvocal[16] expressions (Down & Hogan, 2000). With these features of reflective-interpretive genres, I hope to have been able to construct research texts with richness of meaning via layered textuality (van Maanen, 1988). Here, the notion of layered textuality refers to the extent to which my research genres account for decidability and undecidability, certainty and uncertainty, and ambivalence and bivalence, to name a few.

(b) Performative genres: Performative genres can be defined as an appropriate means for highlighting the praxis-oriented function of research texts, thereby enabling the researcher to take a standpoint of an activist knower rather than an objectivist conformer of pre-existing knowledge. I employed performative genres to demonstrate viable alternatives to neutral, passive and mono-logical research texts that are the hallmark of the genre of positivism. In my writing, I employed elements of at least three types of performative genres: performance theatre, readers' theatre and screenplay (Pelias, 2008). With the use of some aspects of performance theatre, I hoped to resist widespread hegemonies of unidimensional nature of mathematics (see Section One) and reductionist thinking (see Section Three) (Saldaña, 2005, 2008). Sections One to Six of my thesis can be enacted as readers' theatre in which readers can take part in performative reading of my research texts (Donmoyer & Donmoyer, 2008). I hope to have demonstrated some elements of screenplay via dialogic plots of my stories presented as data texts[17] for my inquiry.

(c) Narrative genres: Narrative genres are those which contextualise knowledge claims through cultural stories, folktales, myths and literary tools. I used narrative genres to speak from a lived storied perspective bringing contexts, events and people

[16] I have envisaged that polyvocality is not always about involving voices of Others but also pluralising my 'self' that co-acts with Other.

[17] Here, I could not stay away from the positivistic language. Indeed, the so-called separation between data texts and interpretative texts is one of many ways to represent the structure of the Sections and Chapters of my thesis.

to the textual space, thereby depicting richly the complexity of my experiences as a student, teacher and teacher educator. Moreover, I used narratives to communicate research outcomes with my audience, articulating a host of dilemmas, moral tales, and personal-professional stories that paint an holistic sense of being and becoming (Cumming, 2007). Some of the dilemmas embedded in my stories arose from the conflicting nature of mathematics (see Section One), asymmetrical power relationships in my professional context (see Section Six), and communicative difficulties with Others (Section Two and Three), to name a few. Richly connected with my professional lifeworlds, my narratives embody a moral basis for inclusive and transformative mathematics education in Nepal.

(d) Poetic Genres: I grew up encountering the millennia-old truism of Eastern Wisdom traditions that poetic eyes can reach further than the sun's rays, thereby positing myself as an amateur poet since my childhood. In my research, poetic genres have been used to represent aesthetic-imaginative aspects of my knowledge claims through meter, rhythm, rhyme and playfulness (Christie, 1979). In every section of my thesis, poetic genres complement prosaic genres for evoking emotional, aesthetic and spiritual responses (Shakotko & Walker, 1999). More so, I found poetic genres to be useful for bringing about multiple, interactive and imaginative views of educational reality, thereby helping me to cultivate multi-perspectival envisioning of the issues arising from my research questions (Glesne, 1997).

e) Non-linguistic genres: I take non-linguistic genres as incorporating photographs, paintings, cartoons, collage and creative models, to name a few (Sullivan, 2008). I employed these genres to demonstrate the multi-vocal, embodied and nonlinear nature of my knowledge claims. More so, such non-linguistic genres enabled me to represent particulars, peculiars and extraordinariness otherwise distorted through the mediative process of linguistic textuality (Butler-Kisber, 2008). Another important benefit of using non-linguistic genres is to cultivate visual imaginations that can bring clarity to the articulation of knowledge claims. Similarly, I hope that my non-linguistic genres juxtaposed against the linguistic genres foster pedagogical thoughtfulness in the reader/viewer (van Manen, 1991).

Quality Standards

Informed by a multi-paradigmatic design space, my inquiry cannot be judged exclusively by the quality standards based on the paradigm of positivism. Because the positivistic standards of validity, reliability and objectivity are almost irrelevant for judging the quality of my research process and product, my research standards arise from multiple research paradigms. Let me explain briefly how the quality of my research was regulated by the following set of standards arising from paradigms of postmodernism (incisiveness, illuminating and verisimilitude), interpretivism (transferability), criticalism (pedagogical thoughtfulness and critical reflexivity) and integralism (wisdom).

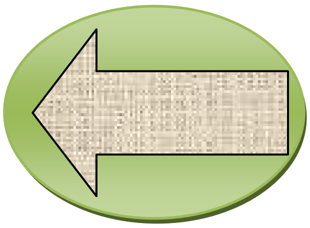
a) Incisiveness: This standard seeks to examine the extent to which my research is focused clearly on the significant issues of mathematics education (Barone, 2007). From an eagle eye view, I hope to have fulfilled this quality standard with a clear focus on the 'macro level' problem of culturally decontextualised mathematics education widespread in the education system of Nepal. More so, investigating this problem was highly significant for developing an overarching inclusive vision of mathematics education in Nepal. From a mouse eye view, I have tried to address the quality standard of incisiveness by focusing on 'micro level' issues such as didactic classroom pedagogies, hierarchical classroom culture, and an exclusive view of curriculum development, to name a few.

b) Illuminating: This research standard is about the extent to which meanings of issues under investigation are enriched, deepened, made vivid, and made more complex (Barone, 2006, 2007; Barone & Eisner, 2006). Primarily, whilst inquiring into particular research issues, I have tried to illuminate subtle but significant research issues by accounting for their vividness and complexity via narrative, reflective, performance, poetic and non-linguistic genres. In particular, these genres helped me speak differently about issues being investigated. Next, I have tried to be referentially adequate in terms of my visibility and the visibility of research contexts through self-conscious and reflexive writing styles. Such visibilities are illuminative because they help

unpack my being and becoming as a complex textual collage of a student, teacher and teacher educator, to name a few life roles.

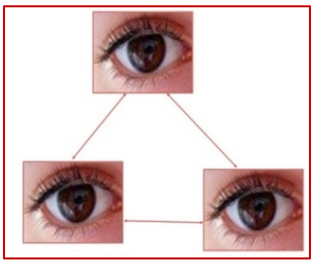
c) Verisimilitude: This research standard is a radical departure from the positivistic research standard of objectively True text. I cannot claim that my stories and vignettes embody objective Truth (for it is difficult access the notion of objectivity without its co-dependent notion of subjectivity, and vice versa), nor do I carry the burden of claiming their absolute realness outside of my experiences (Richardson, 2000). Nevertheless, I uphold the view that my stories and vignettes need to be judged on the basis of their truthfulness and lifelikeness. In the process of judging the fulfilment of this standard, readers of my thesis can ask these questions: 'Do the plots and characters in the stories sound believable?', 'Do intra-story connections between events and contexts seem plausible?' and 'Do the experiences depicted in my stories ring true from your own lived experience?'

d) Transferability: By transferability, a research activity or its product can be transferred to another setting or context by identifying similarities and dissimilarities between the researched and the would-be research site (Guba & Lincoln, 1989, 2005). The notion of transferability is not about the replicability of the entire research program; rather, it is about the adaptability of research aspects to a new context. More so, transferability is also about judging the relevancy of my research agenda beyond my research context. Unsurprisingly, I attempted to address the quality standard by providing rich details of pedagogical contexts, events and moments in which I have experienced culturally decontextualised mathematics education. As a result, future researchers can use some aspects of my research design to investigate similar research agendas. Next, I believe that my visions of an inclusive mathematics education have arisen from my understandings of the problem of culturally decontextualised mathematics education and so I envisage that readers of my research will recognise the transferability of these envisionings to their own educational contexts.



e) Pedagogical thoughtfulness: My next standard, pedagogical thoughtfulness, arises from phenomenological-hermeneutical traditions and addresses the extent to which present and future readers of my texts are evoked to question, reflect and examine their own pedagogical practices (van Manen, 1991). Furthermore, the standard of pedagogical thoughtfulness is also about increasing the likelihood of teachers and teacher educators becoming aware of the deep-seated assumptions guiding their beliefs. I have attempted to address this quality standard in my research by generating evocative, perspectival and dialogic texts. To see if my research texts fulfil the criterion of pedagogical thoughtfulness, readers of my research may ask the questions; 'Is the research text engaging?', 'Does the researcher invite readers to reflect upon their perspectives on issues being discussed?' and 'Does the research text offer perspectival envisioning about addressing the problem being investigated?

f) Critical reflexivity: The term reflexivity signifies the extent to which the researcher has made his/her background information available to readers. By this, the readers will be able to judge, without difficulty, the researcher's predisposition. This basic meaning of reflexivity needs further extension for examining critically the researcher's false consciousness accumulated via her/his chosen epistemology, methodology, and theoretical referents. Therefore, the idea of critical reflexivity entails the notion of exposing myself as well as being self-conscious of my own (unfolding) subjectivity, thereby being aware of the limitations of my chosen epistemology, methodology and theoretical referents (Denzin, 2003b). Arising from the critical research paradigm, the standard of critical reflexivity can therefore be judged by the extent to which: (a) I have made the process of interpretation visible to readers; (b) I have reflected critically upon my assumptions as a researcher; (c) I have consciously and critically reflected upon my evolving subjectivities (false consciousness) throughout the process of inquiry; and (c) my textual constructions did not arise from isolated naval gazing, thereby envisioning present and future praxis for an inclusive mathematics education.



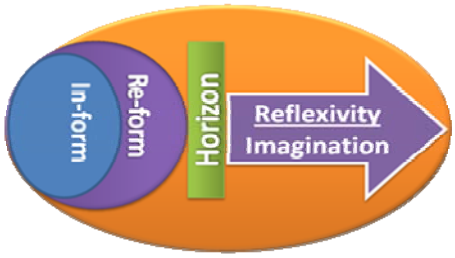
g) Wisdom: Growing up as an adherent of Vedic (and aspects of Buddhist and Animist) traditions, the notion of wisdom has been embodied in my flesh and thinking with a number of archetypes of wise persons. Retrospectively speaking, three key commonalities of such wise personalities that I have carried with me are: (a) inclusiveness in their thinking and actions, (b) being less presumptive about people and their viewpoints, and (c) having compassion for the wellbeing of others (Bahadur, 1983; Henderson & Kesson, 2004; Maxwell, 2006). After reviewing integralism (of Sri Aurobindo and Ken Wilber), I began to see connections between my culturally ingrained view of wisdom and its paradigmatic articulation which seems to portray wisdom as an ability (a) to embrace humility, (b) to manage adversaries, and (c) to develop visions for the wellbeing of others. In my research, although it is not completely possible to embrace humility, I tried to apply aspects of it by admitting my un-knowingness (Weick & Putnam, 2006). To see if my research texts have fulfilled the criterion of humility, readers of my research may ask the questions; 'Do I appear to be less presumptive about contentious issues?' and 'Do I appear to be aware of limitations of epistemologies being employed in this research? Similarly, rather than taking a dualistic position, I addressed adversaries with the help of dialectical and other holistic thinkings. Finally, readers of my research can see if my visions contribute to the wellbeing of others by responding to these questions: 'Do I go beyond the generation of assertions, thereby demonstrating possible methods of solving problems?', 'Do I demonstrate a long-term view about how my inquiry contributes directly to the wellbeing of participants?' and 'Does my research engage in practical reasoning in relation to solving the problem?'

Ethical Obligations

Once the moral positions of desire-less action are upheld, every karma yogi (i.e., actor who abides by selflessness) becomes clear about every purpose of his/her life. This popular dictum from the Gita (a Vedic text) sounds somewhat contradictory if we read it literally. However, a metaphorical reading of the dictum can offer insights into the much needed primacy of moral standpoints of selflessness over any other standpoints (e.g., epistemological and ontological). More so, the dictum seems to emphasise acting for the goodness of others, without having desires of personal fulfilment. Although it may be very difficult to avoid the desire of personal fulfilment, the ethical purpose of working for the public good is highly relevant for my research. With this cultural root of my moral positioning, I tried to abide by the following moral and ethical obligations throughout this inquiry.

a) Ethic of care: An ethic of care entails a deep and committed relationship that is based on mutuality, relatedness and trust among people. In my research, such an ethical position was employed in two ways (Noddings, 2006). First, I took this ethical position as an orienting axiological standpoint to speak for those who need to be cared for. Here, I am referring to students (and teachers) who are situated at the receiving end, and who suffer from the exclusivity of culturally decontextualised mathematics education. Second, in the process of constructing narratives, I ensured anonymity by using pseudonyms and composite characters that allow me to represent specific common traits, qualities and attitudes rather than represent exact persons with whom I worked as a student, teacher and teacher educator. Furthermore, I also considered carefully the desired degree of exposure (i.e., vulnerability) of myself for my own safety and care.

b) Ethic of civic transformation: I believe that an important ethical and moral obligation as an educational researcher is to abide by the purpose of civic transformation (Denzin, 2003a). Through this moral and ethical obligation, my research subscribes to the view that mathematics education is also a civic enterprise and that transforming the exclusively decontextualised nature of mathematics education can contribute to raising civic awareness about possible empowering roles of mathematics education in citizens' lifeworlds. More so, I aimed to build solidarity among educators on an inclusive mathematics education that brings otherwise neglected (perhaps subaltern) voices to the fore of its pedagogical space. Staying away from the morally neutral researcher of positivism, my research texts purport to unravel how the phenomenon of culturally decontextualised mathematics education distorts the consciousnesses of students, mathematics teachers and teacher educators. In a nutshell, this ethical standpoint enabled my inquiry to provoke transformation with an emphasis on research texts of civic interests.



c) Ethic of responsibility: Although my research focuses on my own professional practice, it also abided by what Levinas calls an ethic of responsibility (Blades,

2006). Levinas argues that ethics is the first philosophy of humans because in the absence of ethical responsibility social interaction, mediation and other inter-subjective endeavours are less likely to materialise. Indeed, the selection of research problem and research design might have been driven by an ethic of responsibility toward Nepali students (and teachers) who have been facing the torment of culturally decontextualised mathematics education.

d) Ethic of compassion: Ethics of research that is undertaken within the paradigm of positivism are less likely to allow the researcher to be compassionate about the research participants (i.e., informants, readers and beneficiaries) (White, 1999). Such a paradigm is likely to promote an ethical view of non-engagement, distanciation, bureaucratisation and dualism. Consequently, the notion of a compassionate (and passionate) researcher does not seem to fit well according to the ethos of positivism because researchers within this paradigm are likely to follow dispassionate, impersonalised and decontextualised representations of knowledge claims. On the contrary, I endeavoured to employ an ethic of compassion in my knowledge claims. According to Eastern Wisdom traditions, an ethics of compassion entails concerns about and desire to alter the suffering of others. In my research an ethics of compassion was employed in three ways. First, I attempted to foreground through my research texts that connectedness is vital for a transformative vision of anything, including mathematics education. It could be through connectedness that I was able to empathise with the possible sufferings of students arising from the exclusive reproductionist agenda of mathematics education.

Second, I attempted to demonstrate how dualism and reductionism (sources of suffering) are not helpful for conceiving a sense of inclusive self (i.e., selflessness), a basis for educators to be liberated from pedagogical narrowness. Third, my narratives aim to offer insights into the interiority of students (and teachers) as sufferers due to unjustifiable epistemic and pedagogical assumptions of culturally decontextualised mathematics education.

Section Zero

Formation of Sections and the Structure of My Thesis

As I outlined in Chapter Minus One, my research questions grew out of my personal and professional experiences as a student, teacher and teacher educator. Thus, each of my research questions has a history, is associated with specific professional contexts, and is linked with particular issues and dilemmas that I faced in my professional lifeworlds. The phenomenon of historicity attached to my research questions enabled me to employ a diachronic structure as a key basis for organising the journey of my emergent inquiry in this thesis. I considered research themes and issues embedded in the research questions as another basis for constructing Sections and Chapters of this thesis. In this way, I departed from the conventional structure that employs a pre-given set of 'topics' reflecting exclusively impersonalised, history-free (sic) knowledge claims, thereby constructing a thesis structure that is more reflective of my inquiry. The following table depicts the relationship between my professional contexts, the research questions and Sections of the thesis.

Timeline and Professional Contexts	Research Questions	Themes and Sections
1994: As a B Ed student 1999: As a teacher trainer 2006: As a teacher educator, coordinating the mathematics teacher education program at the University of Himalaya	In what ways has the nature of mathematics as a body of pure knowledge been governing the existing mathematics education in Nepal? In what ways can this nature promote an exclusive and decontextualised mathematics education? How can a multidimensional nature of mathematics be conceived as a basis for inclusive mathematics education?	Nature of Mathematics (see Section One)
2004: As a teacher educator communicating with school principals and visiting their schools	In what ways does dualism restrict mathematics education from using agentic and inclusive pedagogical visions? What may be some unhelpful dualisms that govern mathematics education? How can those unhelpful dualisms be addressed for envisioning inclusive pedagogical visions?	Unhelpful Dualisms (see Section Two)
2004/5: As a teacher educator, tutoring mathematics education units	What is reductionism? In what ways does reductionism promote culturally exclusive and elitist views of mathematics education? In what ways can the disempowering influence of reductionism be overcome in curricular, pedagogical and assessment-related practices?	Reductionism in Mathematics Education (see Section Three)
1995: As a teacher working in a private	In what ways do conventional logics (propositional, deductive and analytical)	Alternative Inclusive Logics

school of Kathmandu Valley 2006: As a teacher educator, lecturing students in a unit called mathematics education.	orient mathematics education in Nepal? To what extent are these logics unhelpful for constructing an inclusive and transformative vision of mathematics education in Nepal? In what ways can mathematics education in Nepal embrace a multi-logics perspective for developing an inclusive mathematics education?	(see Section Four)
2005: As a curriculum worker, participating in the discourse of curriculum designing.	In what ways is the mathematics curriculum in Nepal guided by the disempowering notion of a narrowly conceived modernity? How can curriculum workers (like myself) act inclusively to transform the modernist-inspired exclusionary practices of designing and implementing the mathematics curriculum in Nepal? In what ways can I develop a transformative curriculum vision for mathematics education that is inclusive of sometimes opposing knowledge systems, perspectives and ideologies?	Curriculum Issues (see Section Five)
2005: As a committee member working toward formulating a two-year teacher education program.	In what ways do exclusive views of globalisation, an extreme view of foundationalism, and a narrowly conceived view of mathematical language prevent mathematics teacher education programs from becoming an inclusive and transformative educational endeavour? What are likely to be key perspectives that overcome such exclusionary views for conceiving a vision for an inclusive mathematics teacher education?	Globalisation, Foundationalism and Mathematical Language (see Section Six)

This thesis is organised according to a hierarchy of Sections, Chapters, subsections and paragraphs. Specifically, Sections One and Three use *Episodes* and *Acts* in place of Chapters and subsections as they were composed entirely as performative texts. Although each section is unique in terms of its structure, Section One through Section Six share three common features: (i) each Section addresses a particular set of research questions arising from the excavation of my lifeworlds, (ii) each Section reports my explorations of concepts, issues and phenomena embedded in the research questions, (iii) each Section foregrounds narrative and diachronic representation, and (iv) each Section presents my envisioning as a means for addressing problems expressed via the research questions. In the following paragraphs, I present a brief outline of each Section of the thesis.

- Section Zero explores the research problems and methodological issues of my research. Moreover, this Section articulates how my research problems are deeply embedded and embodied in my professional lifeworld and how an emergent, multi-paradigmatic design space fits well as per the nature of the key research problem.

- Section One reports my inquiry into the unidimensional nature of *mathematics as a body of pure knowledge* and presents a multidimensional nature of *mathematics as an im/pure knowledge system* as a possible basis for an inclusive mathematics education. This Section also incorporates my exploration of different types of dialectics arising from different cultural traditions.

- Section Two explores key features of the prevailing dualism in the field of mathematics education. Situating myself in the year 2004 when I was involved in launching a one-year mathematics teacher education program, the Section portrays my articulation of inclusive pedagogies via the metaphors of thirdsapce and dissolution as a way of addressing the exclusionary posture created by many unhelpful dualisms.

- Section Three addresses the problem of different types of reductionism that orient mathematics education in Nepal. Guided by the epistemic technique of performative imagination, this Section unravels my encountering of reductionism as a teacher educator in the years 2004 and 2005.

- Section Four identifies four *new* (additional alternative) logics as a means for conceiving an inclusive mathematics pedagogy that has been un/wittingly assaulted by propositional, deductive and analytical logics.

- Section Five presents the process and outcomes of my inquiry into the formulation of a synergistic and transformative image of *curriculum as montage*, a basis for developing an inclusive mathematics education in Nepal.

- Section Six deconstructs the narrow view of globalisation, foundationalism and mathematical language (i.e., analytical proof) that I encountered whilst working with teacher educators and professors in Nepal. This Section also delineates my envisioning of ways to transform narrow views of globalisation, foundationalism and mathematical language through dialectical logic.

- Section Seven puts forth a reflective summary of my journey as a researcher via a retrospective voice. More so, it brings forward how my research might be helpful for my present and future practice as well for mathematics teachers and teacher educators in contexts similar to those depicted in the thesis.

Section Summary

Section Zero (comprising Chapters -1 and 0) has delineated the key research problem of culturally decontextualised mathematics education that I experienced as a student, mathematics teacher and teacher educator, thereby articulating the much needed research design for my inquiry. Whilst exploring the key research problem, I identified six research agendas arising from my professional and personal lifeworlds. Given the multifaceted and complex nature of my research problem, I conceived a multi-paradigmatic design space for undertaking the inquiry. More so, I identified autoethnography and small p philosophical inquiry as my main methodological referents, together with performative and narrative imaginings as epistemic techniques of my inquiry. Constructing quality standards based on the paradigms of interpretivism, criticalism, postmodernism and integralism, I described how Sections of the thesis evolved diachronically.

SECTION ONE: ENVISIONING A MULTIDIMENSIONAL NATURE OF MATHEMATICS FOR INCLUSION AND EMPOWERMENT

Orientation

In Section Zero of this thesis, I articulated how culturally decontextualised mathematics education has become the research problem, thereby highlighting the following key dimensions of the research problem as the themes of my inquiry: (i) unidimensional image of the nature of *mathematics as a body of pure knowledge*, (ii) unhelpful dualisms orienting mathematics pedagogy, (iii) hegemony of reductionism in various aspects of mathematics education, (iv) narrowly conceived notion of logic widespread in mathematics pedagogy, (v) restrictive image of *mathematics curriculum as an object* preventing mathematics education from being a transformative learning enterprise, and (vi) restrictive perspectives orienting the formulation of an inclusive mathematics teacher education program. Given these key themes of the inquiry, I focus on the first theme (i.e., unidimensional image of the nature of mathematics) with these three research questions as the primary basis for my inquiry in this section: (*i) In what ways has the nature of* mathematics as a body of pure knowledge *been governing the existing mathematics education in Nepal?, (ii) In what ways can this nature promote an exclusive and decontextualised mathematics education?, and (iii) How can a multidimensional nature of mathematics be conceived as a basis for an inclusive mathematics education?*

With these research questions at my disposal, my inquiry in this section aims first to explore key features of the nature of *mathematics as a body of pure knowledge* and those of its sometimes antithetical nature of *mathematics as impure knowledge* in relation to their possible epistemological and pedagogical implications for mathematics education. Second, I endeavour to elaborate different forms of dialectics as a means for reconciling sometimes contrary views of the nature of mathematics. Finally, I intend to develop an empowering nature of mathematics that is helpful for conceiving an inclusive mathematics education in Nepal.

Section One

Given the key purpose of developing a transformative vision of the nature of mathematics, I have used dialectical logic as a conceptual referent for my inquiry. Although I have elaborated different forms of dialectical logic in the third Episode (i.e., Chapter 3) of this section, I would like to briefly clarify its meaning here. Conceived as a useful thinking for addressing everyday contradictions, dialectical logic can be portrayed as the logic of 'and', meaning that sometimes opposing entities, constructs co-exist in our lived reality (Basseches, 2005). Unlike the conventional formal logic of dualism (the logic of 'either or'), dialectical logic is useful for conceiving the view that our lived reality is always in the process of change, adaptation and emergence, and that there are various forms of dialectical logic embedded in various cultural traditions of the East and West.

Using my experience as a student, teacher and teacher educator, I have constructed a five composite-story sequel, *Experiencing A Fractured Worldview*, as data-texts of my inquiry (van Manen, 1995). Here, I have used the epistemic technique of performative imagination which entails the praxis-oriented view of knowledge that writing (being here) and experiencing (being there) are linked through performative relationship, thereby opening a hybrid space of writing as acting a*nd vice versa* (see Section Zero; Denzin, 2003a; Morgan-Fleming, 1999). Organised in an emergent structure of episodes, acts and performances, the section can also be performed by the first time readers without any rehearsal (Donmoyer & Donmoyer, 2008).

With the help of three signature stories of the series, *Experiencing A Fractured Worldview,* constructed on the basis of my experiences as an undergraduate student in 1994, as a part-time lecturer in a teacher education college in Kathmandu in 1998, and as a teacher trainer in the University of Himalaya in 1999, I have explored key characteristics of the nature of *mathematics as a body of pure knowledge* in the first Episode of this section, *The Nature Of 'Mathematics As A Body of Pure Knowledge' Is NOT Inclusive.* This episode presents my critical view of the hegemonic ideology, epistemology, language and logic embedded in the nature of *mathematics as a body of pure knowledge*.

Similarly, I unpack key disempowering features embedded in the *nature of mathematics as impure knowledge* in the second episode of this section, *NOR Is The Nature of 'Mathematics As Impure Knowledge' Inclusive*. With the help of two signature stories, *Experiencing A Fractured Worldview IV and V* constructed on the basis of my experience of undertaking my masters' project in 2003 and working as a teacher educator in the University of Himalaya in 2006, this episode presents my inquiry into a static view of culture, the hegemony of a singular view of mathematics, and unhelpful dualisms possibly arising from the nature of *mathematics as impure knowledge*. In the third and final episode of this section, I begin with different forms of dialectics (dialectical logic) arising from Hegelian, Adornoian, and Eastern Wisdom Traditions. With the help of these different forms of dialectics, I hope to generate an inclusive nature of *mathematics as an im/pure knowledge system* where the label 'im/pure' signifies an inclusive space for conceiving different forms of mathematics. Finally, the following list of characters embedded in and arising from my professional life as a student, lecturer, teacher trainer, researcher and teacher educator, including their roles and attributes, is helpful for performers to have a pre-performing understanding of their potential roles in this plurivocal performatively imagined space.

Key characters in the performance	Description	Timelines and features
Director	A backstage character who facilitates and manages the performative inquiry by various means including making announcements to the audience and giving appropriate clues to the performers.	Begins the inquiry in the middle of 2006, grapples to create dialogic texts, and constantly reflects upon his role as the director of his own inquiry.
Narrator	An onstage performer who plays the key role of the inquirer.	Reflects upon his experience as an undergraduate student in 1994, a part-time lecturer in early 1998, a teacher trainer in 1999, a researcher in 2003, and a teacher educator in 2006, constructs performative narratives aiming to generate an inclusive nature of mathematics
Storyteller	An onstage performer who tells stories of his experience as a student, lecturer, teacher trainer, researcher and teacher educator.	Writes stories on the basis of his past and present roles as a student, teacher and teacher educator.

Key Characters	Their roles in the story sequel, Experiencing A Fractured Worldview
Me as an undergraduate student	A protagonist character of the story, Experiencing Fractured Worldviews I, who wishes mathematics to be free from abstract, algorithmic and disembodied genres but accepts the widespread view that we can do nothing about such a nature of mathematics.
Other undergraduate students	Supporting characters in the story, Experiencing Fractured Worldviews I, divided into three camps: radical, midlist and status-quoist, midlist and status-quoist prevails in the end.
Mr Algebra	A character who holds the view that undergraduate students cannot critique the nature of mathematics, follower of didactic teaching method, does not like questions raised by students.
Me as a lecturer	A character, representing myself as a part-time lecturer of calculus, has some sympathies on heretical views of mathematics but cannot bring them to the foreground.
Prabhat	A student of my calculus class, raises questions, at times shows his critical posture toward the prevalent nature of mathematics.
Me as a teacher trainer	The key character in the story, Experiencing The Fractured Worldviews III, wishes to promote student-centred teaching, has developed some techniques about involving students in mathematics learning, has somewhat naive view of student-centred teaching, still not clear about the nature of mathematics that fits well with his agenda of student-centred teaching
Shankar	A character representing an in-service trainee teacher under my facilitation, often resists employing student-centred teaching methods, defends his extremely didactic and self-serving pedagogy.
Me as a researcher	Represents a slice of my perspective and life as a researcher in 2003, is very critical of pure mathematics, at times finds it hard to convince other people about his perspectives about culturally contextualised mathematics education.
Ramesh	A character representing some Nepali students doing postgraduate studies at one of the Western Australian universities, have a conservative view about the nature of mathematics and its pedagogy.
Me as a teacher educator	A character dealing with students' dissatisfaction about the subject matter of two units and their tutors' pedagogical styles, strengthens his antagonism with the widespread view of mathematics as a body of pure knowledge.
Students of University of Himalaya	A group of students undertaking postgraduate studies in mathematics teacher education program at the University of Himalaya
Tutors of 'Pure Mathematics' units	Characters representing two mathematics professors who have a very restrictive view of mathematics as exclusively infallible knowledge, consider transmissionism as the only pedagogy of mathematics.

EPISODE I (OR CHAPTER 1): THE NATURE OF MATHEMATICS AS A BODY OF PURE KNOWLEDGE IS NOT INCLUSIVE

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

CURTAIN RISES

Act 1: Experiencing a Fractured Worldview I

STORYTELLER**: **(sound effect, classical flute music, is on. stands next to chair.) It can be any weekday in the month of April 1994. This is the fifth month since started my undergraduate study. Today, I am with my classmates, sitting on an open field next to our classroom and sharing our difficulties that we have been facing in mathematics units particularly in Algebra. Although we do not have a specific agenda for the day, Kranti, one of the students of the mathematics group, wants to kick off the informal meeting by sharing his recent standoff with the lecturer of Algebra unit, named Mr. Algebra. As most of the friends are busy having side talks, I seek their attention to listen to Kranti. In the meantime, the group becomes relatively quiet, similar to an ocean returning to its normal tranquillity after a chaotic Tsunami.

(sound effect out)

"Let's discuss the possibility of developing some useful strategies to cope with the mathematics course that we are undertaking. I don't have a good feeling about Algebra since my bitter exchange with Mr. Algebra. If this is how our study is going to be we will not be able to achieve anything apart from the daily eulogy of mathematics by Mr. Algebra," Kranti speaks passionately as if he is going to lead a protest rally.

"Which bitter exchange are you talking about? Can you guys share what happened between Kranti and Mr. Algebra during last Monday's class? I missed that particular class as I went to the Kalanki Buspark to receive my brother and his

friends," Prasna raises questions and other students appear committed for a mindful listening.

No one speaks for a while. Perhaps, each of us is waiting for others to speak. Someone points to me to say something about the incident as I helped Kranti calm down during the unhealthy exchange.

"Well, Kranti suggested that Mr. Algebra needs to change his teaching method to help us clearly understand the subject matter. It was a kind of direct suggestion in front of all students. Then Mr. Algebra became very angry and called Kranti as an immature critic. Kranti continued to insist that he has not understood a single concept in Algebra whereas Mr. Algebra rebuffed that Kranti needs to realise the very nature of Algebra. The lecturer further said that mathematics is abstract, formula-based, symbolic and algorithmic so Kranti needs the right attitude, an enormous memory and thinking style to be successful in mathematics. Witnessing the unending verbal exchange, I proposed that the lecturer and Kranti talk about it after the class. Indeed, I pressed Kranti to stop engaging in this unending verbal exchange for the sake of the smooth operation of the class even though being in the algebra class is all about copying notes from the chalkboard," I report my version of the Kranti versus Mr. Algebra saga as if I am speaking to a group of journalists.

"Well, I have had a similar experience but with the lecturer of Modern Mathematics. Last week, I met the lecturer outside the classroom and sought his further explanation on the proof of the trilateral theorem[18] *of non-Euclidean Geometry. He repeated three/four times that I need to learn to understand, memorise and apply the right proof in the right place. Indeed, it is awful to hear every time that mathematics is abstract and algorithmic rather than some creative explanation of the concept. But what can we do here? All mathematics lecturers are alike. Perhaps we need to find amicable and tactful ways to work with them," Samajh shares his experience with a passion, as a volley ball drops into our group and smashes one of us.*

[18] The theorem is stated as: Angle sum of a trilateral is less than 180 degrees.

All of us are captured by Samajh's explanation as he is popular for speaking passionately and engagingly. I plan to say something, but Kranti succeeds me this time.

"Guys, our primary goal in doing this course is to pursue a career in mathematics teaching. We may choose a pure mathematics stream in our future Master's course, but that is always our secondary option. How can we teach our students well without having a good understanding of mathematical concepts? I suspect that we will not be able to make good sense of a single concept of Algebra by the Mr. Algebra way of teaching. Why does he refuse to give some contextual examples? Last week, he was talking about divisibility and he made it worse than ever by talking through muted symbols and not giving a single concrete example," Kranti's mouth stops here, as I attempt to speak insightfully into the rift between Kranti and Mr. Algebra.

"Kranti, you are right that Mr. Algebra was not listening to you properly and was denying that no improvement is needed in his teaching. However, it may not be their problems alone. Maybe it is because of the syllabus that has been followed by the faculty? Remember, what the higher geometry lecturer who is very friendly, helpful and communicative, said last week that he cannot connect mathematical theorems with everyday examples because he never had such an orientation during his life as a student. Perhaps, mathematics known by our lecturers is all about abstract theorems and mechanical algorithms. Have we experienced anything different so far?," I try to pacify Kranti at least for a while and expect other students to put forth their perspectives on our lecturers' view of mathematics. But in my mind the image of Algebra Lecturer appears vividly as depicted by the poem, Mr. Algebra Never Smiles. **(points to the poetic poster, Mr. Algebra Never Smiles, pasted on the wall)**

Mr. Algebra never smiles!

He speaks a foreign language. He
He does not try to understand us. He
He appears always angry. He
Mr. Algebra never smiles. He

He says questions are 'bad omens'. He
He finds other voices as interruption. He
He is a lone sovereign of our class. He
Mr. Algebra never smiles. He

He makes us copy from the board. He
He instructs us to say 'yes I got that'. He
He does not think 'we can do'. He
Mr. Algebra never smiles. He

He favours rote memorisation. He
He talks to the chalkboard. He
He rejects culture-math synergy. He
Mr. Algebra never smiles. He

(stands) *Our group of nearly ten students keeps mum for a while. The March day is getting hot as the hour hand of the tower clock moves toward the last digit of the clock's arithmetic. No one seems to care about the time as we still have to wait for an hour to start the lecture on non-Euclidean geometry.*

"Well, I think that these lecturers are not autonomous; they are simply means to another end. All the syllabuses are designed by the university's central office and the end-of-year exams are conducted by the Office of The Controller of Examinations. Listen friends: an important fact is that mathematics is always like this. Let us try not to expect stories in mathematics class. At some point, I also think that the Algebra Lecturer is correct to label us immature critics of mathematics. Why do we not follow teachers rather than indulging in a critical review of their teaching method," Samarpan demonstrates his anti-Kranti posture by opportunistically exploiting my and Samajh's somewhat mediative voices, while Kranti prepares himself for another protest. But Madhyam occupies the space.

"Guys, let's try to focus on doing something, a change-oriented task here. I am not satisfied with Mr. Algebra's class either. Do you think that our problem of not having meaningful understanding of mathematics will be solved if we start fighting with Mr. Algebra? I don't think so. We can request in a diplomatic way for more contextual examples to illustrate definitions and theorems. I hold the view that we better stop being worried about the type (and nature) of mathematics that is included in our syllabus. Why should we be worried so much about a matter that we cannot make any difference? Instead of worrying about the type (and nature) of mathematics, let's find ways to cope with this. Perhaps, this is the nature of mathematics and we cannot do anything about it now," Madhyam finishes his short lecturette, and most of the students seem to follow his view.

(sits) *We are all busy talking to each other. It seems to me that everyone wants to speak about their experiences of mathematics learning. After a couple of minutes, we start listening to each other again. All these voices entail anxieties and worries about the type (nature?) of mathematics and the didactic method that has been employed to transmit such mathematics. But we all agree that altering the type (nature) of mathematics is beyond our reach. We all feel that we are not in the position of doing anything apart from requesting our lecturers to use contextual examples whilst defining new concepts, proving theorems and solving algorithmic problems. Will* *they accept our request? Probably the lecturers will re-enforce again their long-held view that mathematics is always abstract, algorithmic and culture free, and that connecting it with real world examples is a futile act.*

(sound effect: slow drumbeat for about one minute. curtain falls. stage light is off.)

CURTAIN RISES

Act 2: Experiencing a Fractured Worldview II

STORYTELLER: (sound effect, slow soft harmonium, is played. sits on the chair) *It can be any day in May 1998, I am teaching differential calculus to a group of undergraduate students at a teacher education college in Kathmandu. It is my fourth month since I started teaching here as a part-time lecturer of the Department of Mathematics. Except for one/two frequent questioners, all my students are muted followers. So, whenever I enter the class, I feel like being the lone sovereign of this place. But today, I am experiencing something unusual. "Sir, why do we do this differential calculus? What is its value in our life?," asks one of the frequent questioners, named Prabhat, looking at the chalkboard where I have just completed an algorithmic sample solution for them to copy and follow to solve 'sums' under the topic of Mean Value Theorem.*

Other students laugh at Prabhat, creating a buzz in the small room with slogans written on the yellowish wall in favour of different student organisations. As I am searching for possible answers to respond to the questions, another student overtakes me with a couple of counter questions to Prabhat: "Aren't you mad? Why are you suddenly raising the question about the value of mathematics?" Without giving any chance to Prabhat to respond to these questions the next student throws yet another salvo at him: "Don't you know that we are studying here to be competent teachers of mathematics?"

Again a muted silence prevails in the classroom for about a minute. Most of the students are busy copying my notes from the chalkboard. I am trying to respond to Prabhat's question creatively here. But I am not able to find any satisfying answer. Indeed, it is not a wise idea to replay Euclid's answer to one of his reluctant disciples – your learning of mathematics should be for the sake of mathematics -- nor dare I recite David Hilbert's depiction of mathematics as a game played according *to certain (heartless) rules with meaningless symbols. As the second hand of the wall clock keeps on ticking, my mind runs here and there to find a convincing answer to Prabhat's questions.*

"Guys, I have some legitimate reasons to raise these questions. All of us have experienced mathematics as meaningless symbols, a singular method, dry algorithmic proof and abstract definitions. I am tired of doing this type of mathematics. I may be wrong but isn't there any other forms of mathematics that provides us with opportunities to engage in day-to-day problems related to our lives? Why do we continue to reproduce these theorems if they are not useful apart from teaching as our lecturers do?," Prabhat continues to raise his question, as I am almost speechless because of being unable to generate a satisfying answer to his question.

Why didn't I speak from my heart? Why didn't I reveal my inner spirit? Why didn't I sympathise dissidents? Why didn't I look for meaningfulness? Why didn't I reflect on my expressions? Why didn't I show my concerns? Why didn't I explore possibilities? Why didn't I go for alternatives? Why didn't I consider contexts? Why didn't I look for local examples? Why didn't I think about alternatives? Why didn't I ask students for questions? Why didn't I confess about not-knowing? Why didn't I think about being? Why didn't I hear my soul speak? Why didn't I unpack my beliefs?

Prabhat's reflection of our mathematics class creates enough space for students to act out different roles. Antagonists keep on pressing the view that mathematics is always like this, that Prabhat is a whimsical maverick, and that it is too early for Prabhat to talk about philosophical ideas. A handful of protagonists insist that Prabhat has every right to know the usefulness of the subject matter they are studying, that Prabhat is entitled to be sceptical about anything including mathematics, and that Prabat's question helps them think deeply about (the nature of) mathematics itself. As the students are busy having friendly exchange of their views of mathematics, I continue to immerse my thinking in Prabhat's questions. Indeed, these are my questions too. Nevertheless, I am unable to confess this very realisation of mine in front of these students. My educational upbringing has embedded a baggage in my personality, that I need to defend this disempowering nature of mathematics as a body of pure knowledge. My mathematics professors have given me the mantra that to be a good teacher in mathematics I need to deny every idea that does not go well with this nature of mathematics.

"Well, as an undergraduate student like you, I raised similar questions to my professors. Now, I realise that these questions are not helpful for us to understand the true nature of mathematics. Mathematics is a discipline that promotes logical thinking, analytical proof and well structured algorithms. It is not a subject that promotes soft, fuzzy and invalid ideas nor has it much to do with your maverick questions. I think the logical approach that you master by practising algorithmic problems of differential calculus should be helpful in solving problems in your day-to-day life," I plan to play out the recorded version of the same old answer that I have been hearing since I started my primary education (of course in different forms), but an unknown cause prevents this response from going out to the public. Instead, I invite Prabhat to have a discussion after the class and he accepts. Probably he knows my difficulty in dealing with his somewhat difficult but timely questions. My mind delves into a number of whys, as presented in the poster, Whys. ***(points to the poster, Why, pasted on the wall)***

After the class Prabhat and I go to a teashop and have a brief discussion about his questions. Rather than showing my solidarity toward his question, I say to him in a somewhat discouraging tone: "It is good that you raise questions but sometimes your questions are beyond the scope of the subject that I teach. I raised similar types of questions during my student life as well. But I never received a satisfying answer. I think now that mathematics is like this: exclusively abstract, algorithmic and decontextualised."

"Well, I have realised this after the discussion with my class friends. But I still have a deep-seated view that this type of mathematics is not fully helpful for us to be a good mathematics teacher. But never mind! What can we do here, instead of following the prescribed syllabus to be well prepared for the end-of-year exam?," Prabhat postpones here, taking a sip of tea.

We leave the teashop after half an hour. On the way to my house, I ask myself: What is the nature of mathematics? Is it always abstract, disembodied, culture-free, and algorithmic? The truth is: I don't know really as yet. ***(curtain falls. the Storyteller is seen walking backstage. stage light is still on)***

CURTAIN RISES

Act 3: Experiencing a Fractured Worldview III

STORYTELLER: (sound effect, based on a Nepali folk music, is on. the Storyteller appears on stage with a bag of teaching materials. stands.) It can be any day in the month of February 1999. I have left my job of Part Time Lecturer some ten months ago and joined a newly established Department of Curriculum and Instruction of the University of Himalaya. Now my role has been to conduct an in-service teacher training program in the learning area of mathematics. Over these months, I have experienced some changes in my thinking and actions. Probably, I have a deep-seated desire to move beyond the transmissionist pedagogy that is inspired by the narrow view of the nature of mathematics as a body of abstract, algorithmic, disembodied knowledge. Nevertheless, I have not yet developed a language that clearly articulates an alternative perspective embedded in my semiconscious level of thinking. In this situation, I am observing a mathematics class of grade nine[19] taught by Shankar.

"We are going to solve some problems on the topic of Sets. This will be the final class for this topic," Shankar makes an announcement loudly at the time when students are settling from the recess break. I have already taken a seat next to a group of students who appear alert about what they are going to do in the class. ***(sound effect out)***

"We need the correct formula for solving 'exercise' problems quickly and effectively. I shall demonstrate some workout examples for you. And, you will be able to follow the formulae easily," Shankar seems to finish his warm-up lecture, as he grabs the textbook and turns over its pages. In the meantime, students open their notebook, waiting to start copying their teacher's sacred solutions of some selected work-out problems.

[19] Grade level for 14/15-year age groups.

Shankar demonstrates solutions. Students are busy copying them from the chalkboard to their notebook. Shankar explains about the 'technicalities' of solutions. Time passes by as Shankar and students are busy performing their habituated fixed roles. As a teacher trainer who is a recent convert to student-centred pedagogy, I am finding here the opposite. 'Students' participation is non-existent until the 30th minute.' I write down on today's page of the class observation. I wish I could hear some questions and comments from students. At this moment, I start being poetic, experiencing a series of stanzas similar to those mentioned in this poster. ***(points to the poster pasted on the flannel board, Observing A Class. stands and walks to the edge of the stage. comes back and sits on the chair)***

Observing A Class

I am sitting as an observer
In the class of a mathematics teacher
I begin to hear a low voice
"I don't like mathematics
It does not include an image
Nor has it a story of foliage"
Suddenly a loud voice becomes prevalent
The boy's low voice ceases to exist
"This 'step' implies that
That 'step' makes the answer correct"
The loud voice continues to rule
As if there are all muted followers
"Memorise these steps
Your future will be prosperous"
The loud speaker gives instructions
"Follow my sample solutions;
do these rational roots"
Soon, the centralised voice disappears
Decentred voices travel through eardrums
"This is so depressing, meaningless
So much to remember and memorise"
The boy jokes with his friends
"The teacher is irrationalising our lives"
My left ear recognises a new voice
"Why does this class not finish fast?
With this increase in formulae-list,
one day our little head will blast."
All girls chuckle and I notice
But I don't let them know of this
The loudspeaker is muted
Local voices are coming from sideways
"Where do we apply this?"
"Ask him; find the answer, thus."
"You forgot what he will say?
This is useful for our future day."
"Yes, he sounds like a fortune-teller.
Does he really know what will be there?"
Now the loudspeaker is on.
All small voices are gone.
I am also feeling bored
Thankfully, the class is finished

As the class reaches toward the end of its stipulated time, one student who is sitting in the second row says something that I cannot hear properly. As the class goes to a pin-drop silent mode, the student begins to explain how he has solved the problem without any formula. "Cannot we solve these problems without any formulae? Sir, these exercise problems are related to our day-to-day experience. And, I can understand in a better way if I solve without using the formulae that you have given to us. You can check if my way of solving is correct." Now I hear the student very clearly.

Section One

"Don't talk like a nonsense person! You should use the formulae. How can you do mathematics by using your own method? Follow exactly the method and formulae I have given to you. This is what mathematics is all about," Shankar reminds students of their vulnerability and I am really surprised to see that Shankar does not even have a glance at the student's work.

After the class Shankar and I go into the science lab (as no one is there today) to discuss some pressing issues, especially the non-participatory nature of his class. "Shankar-ji, why don't you try to bring some student-centred activities to your teaching?," I ask directly, taking advantage of my one-year senior student status in the Masters program at the University of Nepal[20]*.*

"Well, Bal Chandra-ji, you may be right as a teacher trainer but these students should be able to do real mathematics, not just some humdrum activities. How on earth is mathematics done without formulae, algorithms and symbolic language!," Shankar rebuffs and someone enters the room.

I am in a difficult position indeed. What I have learned over fifteen years of educational life as a student is that mathematical formulae are perfect, the methods are unquestionable, the algorithms are certain. From this perspective, Shankar is right. But I have developed over the recent ten month period a view that student centred teaching is more enjoyable. I have also done some demonstrations on student-centred teaching in schools.

"Well, Shankar-ji I totally agree with what you just said about mathematics. But if we involve students in teaching, it helps them feel positive about their learning. In this way, they may be motivated to study mathematics," I insist, as an attendant brings two milk teas for us.

"Bal Chandra-ji, if we are to truly promote the real nature of mathematics, we need to stay away from feelings. Does feeling make any difference in doing mathematics correctly? As a friend, I can follow and implement some of your suggestions in my teaching. What is the point in letting students share their imperfect (impure) ideas if

[20] Pseudonym of a Nepali university

they have to know the correct formulae, the correct method and the correct algorithm? Indeed, our duty as teachers is to maintain the true nature (infallible, certain, abstract, authoritarian?) of mathematics. And, I have to cover the content as well."

Indeed, I don't have a clear line of thought to challenge his idea about the nature of mathematics as a body of pure knowledge. I envisage that if we keep on performing this type of exchange, it can turn meaninglessly ugly. Finally, I leave Shankar's school with an agreement that I demonstrate my student-centred teaching in his class sometime next week. On the way to university, I keep on asking myself: How can I free myself from the widespread nature of mathematics as a body of algorithmic, certain, infallible, abstract knowledge? Are there any viable alternatives to this nature of mathematics? Does not this view of mathematics impede teachers like Shankar from fully realizing the potential of a more participatory pedagogy? ***(curtain falls. the Storyteller appears to be leaving the stage. stage switch is on)***

CURTAIN RISES

Act 4: Prologue

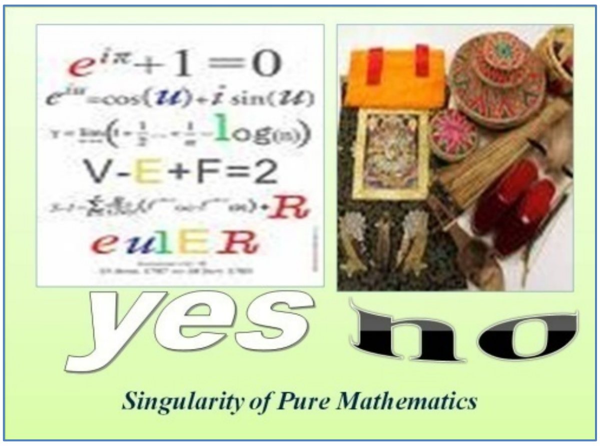
NARRATOR: ***(stands.)*** Let me first unpack two concepts, 'body of knowledge' and 'pure knowledge', embedded in the image of the nature of *mathematics as a body of pure knowledge*. I have taken the idea of body of knowledge to represent the view that mathematics is a collection of already finished knowledge waiting to be transmitted to students (Lerman, 1990). In my experience, this view of the nature of mathematics is represented in the school mathematics education of Nepal by an extreme view that teaching and learning in mathematics is not possible without a textbook and a teacher. Such a body of knowledge is often regarded as rigid, incorrigible and certain, as well as a basis for promoting didactic and non-participatory pedagogies (Ernest, 1994c). Whilst working as a part-time lecturer in the first half of 1998, my firm belief was that the body of mathematical knowledge is entirely different from the body of linguistic or literary knowledge because I hold the view that mathematical knowledge could not be altered whereas knowledge related to the literary or humanities domain could easily be altered or modified. Thus, I have taken the notion of pure knowledge to represent such a view of infallibility embedded in the nature of *mathematics as a body of knowledge*. Moreover, the term, 'pure knowledge', is also taken to represent the widespread view that only 'pure mathematics' represents authentic mathematics whilst all other forms (such as impure: embodied, artefactual, *informal,* communal, ethnic) are not genuinely mathematical. Given this experiential background, I have used these terms to signify 'pure mathematics' or 'pure knowledge': symbolic, abstract, algorithmic, *formal*, and culture-free. However, I have not intended to use these categories as an ultimate representation, rather I have used them as heuristic qualifiers to facilitate my inquiry into the exclusive nature of mathematics as a body of pure knowledge.

Taking these categories as facilitative tools for articulating the notion of 'pure knowledge', let me clarify that the symbolic genre of mathematics is considered by some mathematics teacher educators to be the pinnacle of all existing knowledge systems (Tieszen, 2005). It may be true but this genre of mathematics operates through a reductive view that mathematical language is very selective, specific and highly *bureaucratised* which is what Restivo and Bauchspies (2006) regard as a means for preserving its infalibility. Similarly, another attribute of mathematics that is embedded in the nature of *mathematics as a body of pure knowledge* is its emphasis on abstraction. In my view, mathematical knowledge is made abstract by avoiding lived, felt and experienced realities associated with its process of knowledge constructions (Hersh, 2006). The algorithmic genre of pure mathematics is identified with a set of rules, formulae and procedures that can be used to solve 'problems' in mathematics. In my experience, it can be this genre of mathematics that turns mathematics into a subject of mechanistic rules, formulae and procedures (Linnebo, 2006). The form of *formal* mathematics can be associated with the academic nature of pure mathematics via its emphasis on reductionist logics, such as propositional, deductive and analytical (Dubinsky, 2000). I shall explain these logics under the topic of the logic of certainty in the final part of this episode. Finally, the culminating feature of symbolic, abstract, algorithmic, and *formal* mathematics is the view of mathematics as culture-free subject which also can be a politically motivated expression for not incorporating knowledge systems arising from people's practices (Luitel & Taylor, 2007).

After clarifying (to some extent) the meanings of pure knowledge and body of knowledge embedded in the nature of *mathematics as a body of pure knowledge*, I would like to move ahead with my performative journey into its disempowering features. To do so, I shall elaborate the ideology of singularity that promotes an elitist and decontextualised mathematics education in Nepal. Next, by using my experience as a student, lecturer and teacher trainer as mentioned in the stories, *Experiencing A Fractured Worldview I, II and III*, I am going to explore ways of knowing embedded in the nature of *mathematics as a body of pure knowledge*. With the view that mathematical expressions are always constitutive worldviews, I shall take a performative journey of inquiring into the nature of language/expression promoted by the nature of *mathematics as a body of pure knowledge*. Finally, I shall explore how I have experienced the logic of certainty embedded in the nature of *mathematics as a body of pure knowledge*. ***(curtain falls. the Narrator is still seen on the stage.)***

CURTAIN RISES

Act 5: Ideology of Singularity



NARRATOR: (sits on the chair, next to the pile of books and notebooks. a poster entitled, Singularity of Pure Mathematics, is seen on the wall) Here, I am using the concept of ideology as a body of in/visible doctrine, myth and belief that colonises people’s hearts and minds (Apple, 2004). In my experience, the nature of mathematics as a body of pure knowledge promotes an ideology of singularity, thereby dismissing the need for multiple perspectives in designing the curriculum, conceiving contextual pedagogies and employing authentic assessment strategies. It might be due to this ideology that I constructed the image of mathematics as a foreign subject as a result of not finding any contextual stories in the mathematics textbooks of my primary education. Upon reflection, I know now why teachers of the primary school, where my formal education started, always advocated ‘one single correct method’ whilst teaching us the process of addition, subtraction and multiplication of numbers, which I encountered after the second or third week of my primary education. In my secondary education, the ideology of singularity of mathematics as a body of pure knowledge was further strengthened via mathematical tasks with muted symbols and mechanical algorithms that every student was required to perform exactly in the same way as prescribed by the teachers and the textbook. This experience can have a similar message to that depicted in the poster, Singularity of Pure Mathematics (points to the poster pasted on the flannel board). I envisage that these experiences of mine can be linked with what Reuben Hersh (Hersh, 1997) calls the exclusive hegemony of the front aspect of mathematics in the pedagogy of mathematics. The front aspect often depicts mathematical knowledge as a finished and 'singular' best product, thereby separating it from the context of investigation, construction and development, which can be depicted via the back aspect of mathematics. Indeed, the front and back aspects of mathematical knowledge exist side-by-side, thereby providing ways of renewing mathematical knowledge systems through their perpetual reflexive and interactive relationships. However, neglecting the back aspect of mathematics and over-celebrating its sometimes opposing front aspect has been the hallmark of the nature of mathematics as a body of pure knowledge, thereby masking the ever-present multiplicities embedded in the back aspect of mathematics.

(stands) As I have mentioned in my story, *Experiencing A Fractured Worldview I*, we (me and my classmates) agreed informally that we might not challenge the prevailing singularity embedded in *mathematics as a body of pure knowledge*, an orienting view for several mathematics units of my undergraduate course of study and for the lecturers who taught those units. Here, the notion of 'challenging' entails resisting and questioning, critiquing the hitherto view of mathematics-is-abstract-and-we-cannot-do-anything-about-it, as well as presenting alternative views of the existing teacher-centred pedagogy promoted by the ideology of singularity. Indeed, I am not generalising that all lecturers favoured transmissionist and didactic teaching methods, rather my perception is that the exclusive nature of *mathematics as a body of pure knowledg*e did not help lecturers to embrace empowering pedagogies by incorporating ingredients of contextualised pedagogies of mathematics. Over time, such an ideology led us to think that mathematics is for a select group of students who could have a big memory container or could cope with the torment of decontextualised pedagogies of transmissionism. Here, my notion of decontextualised pedagogy represents ways of teaching mathematics as an exclusive *mathematisation* of concepts, definitions and problems without relating them to contexts (Jablonka & Gellert, 2007). As prospective mathematics teachers' hearts and minds were being colonised by the exclusive ideology of singularly, one could easily imagine how most, if not all, mathematics classrooms across Nepal would be prevented from incorporating knowledge systems arising from students' lifeworlds. ***(walks on the stage. sits)***

Reflecting upon my role as a lecturer embedded in the story, *Experiencing A Fractured Worldview II*, I realise (i) that I was not able to fully recognise that dissenting ideas are essential for a pedagogy that can help myself and my students to shift our thinking toward an holistic view of mathematics, and (ii) that I was unwittingly facilitating future schoolteachers locking themselves in the ideology of singularity. Perhaps, I needed to understand that the 'singularity' of mathematics is just one side of its entirety, for it can be difficult to conceive singularity without multiplicity[21]. By re-reading the story, *Experiencing A Fractured Worldview III,* that reflects my role as a teacher trainer, I have come to realise now that how futile it can be to realise a student-centred pedagogy within the ideology of singularity inspired by the unidimensional nature of *mathematics as a body of pure knowledge*. In a nutshell, the ideology of singularity embedded in such a nature of mathematics is less likely to be helpful for (i) translating mathematics as an inclusive learning activity, (ii) incorporating local cultural practices in mathematics education, and (iii) fostering heretical creativities of students, which may be needed for solving problems arising from their lifeworlds. ***(curtain falls. stage light is still on. a slow drumbeat is played for twenty seconds)***

CURTAIN RISES

[21] I am arguing from the perspective that these two concepts co-arise dependently; One cannot conceive fully the notion of singularity without having the concept of multiplicity. If mathematics is singular on some occasions and contexts, it is also plural on some other occasions and contexts

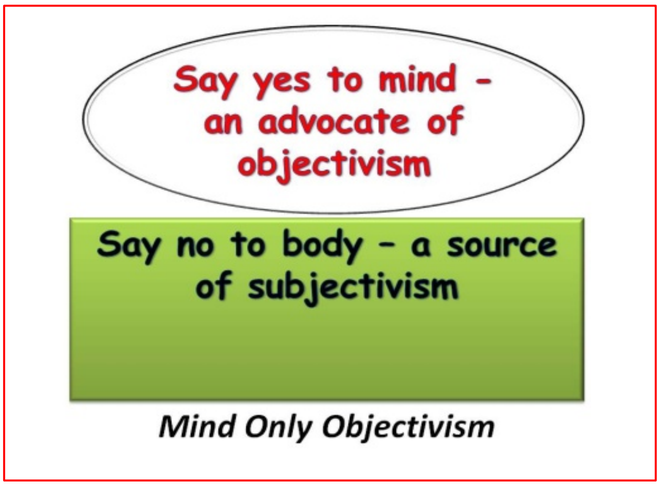
Act 6: Epistemology of Objectivism

NARRATOR: ***(stands. walks around and sits)*** Reflecting upon my role as an undergraduate student depicted in the story, *Experiencing A Fractured Worldview I*, I have come to realise that the dispute between Kranti and the lecturer could have been caused by the epistemological clash between Kranti's collaborative (social constructionist, inter-subjective?) and Mr. Algebra's monopolistic (behaviouristic, objective?) views of mathematics teaching and learning. However, I do not mean to claim that Kranti and Mr Algebra were conscious about their deep-seated pedagogical beliefs and assumptions. In my mind, an objectivist epistemology promotes the view that any mathematical knowledge is constitutive of 'pure Forms' unaffected by cultural, personal and political influences. Viewed from Douglas's (2004) perspective which talks about three modes of objectivity[22], the epistemic aspect of objectivity is about using a rigid (and formal) procedure for making knowledge claims certain. I do not want to play a philosophical game here by dismissing objectivism; rather I would like to speak from my experiential vantage points that an exclusive objectivism embedded in the unidimensional nature of mathe*matics as a body of pure knowledge* is less likely to be helpful for capturing the complex nature of knowledge generation, dissemination and legitimation. I accept that the objectivist epistemology of 'pure' mathematics offers legitimate ways of knowing in some domains of mathematics (Glas, 2006). But in the case of school mathematics education and mathematics teacher education an exclusive emphasis on objectivism does not offer a framework for incorporating the cultural, personal, contextual nature of mathematics knowledge arising from the lifeworlds of students.

(stands) After re-reading the story, *Experiencing A Fractured Worldview III,* I have come to realise that an exclusive emphasis on the epistemology of objectivism might have weakened the creativity that I needed to address the heretical (or critical) view of mathematics embedded in questions of the student character, Prabhat. This can be an example of how an exclusive epistemology of objectivism embedded in the

[22] Objectivity as 'getting at objects', objectivity as reasoning, objectivity as epistemology

unidimensional nature of *mathematics as a body of pure knowledge* is unhelpful for



acting creatively (and holistically) in pedagogical contexts. Indeed, an extreme objectivism seems to emphasise a mind-centric view of mathematics, thereby un/wittingly promoting an unhelpful body-mind dualism which cultivates the view that mathematics is exclusively a mind-centric exercise as portrayed in the poster (***points to the adjoining poster, Mind Only Objectivism***). I argue here that it can be this epistemology of mathematics that does not help conceive contextual pedagogies inclusive of students' curiosities arising from their personal, cultural and social lifeworlds. It is my heartfelt view that if we continue to celebrate an extreme epistemology of objectivism we may not be able to conceive a mathematics education inclusive of students' creative subjectivities.

Arriving at this stage I argue that the epistemology embedded in the nature of *mathematics as a body of pure knowledge* may not promote agentic, participatory and collaborative pedagogical approaches. Why? It can be because of objectivism's emphasis on a narrowly conceived analytical method of knowing (Bernstein, 1983; Laudan, 1996). And, an analytical method of knowing is likely to promote an *a priori* view of mathematics, meaning that mathematical knowledge is descended from unchanging laws, formulae and definitions. I am doubtful that agency-oriented pedagogies are likely to take place by rejecting an *a posteriori* view of mathematical knowledge. Here the notion of a posteriori view is taken to represent an actor-generated perspective of mathematical knowledge. Indeed, *a priori* and *a posteriori* views of mathematical knowledge exist side-by-side forming interactive relationships between their sometimes opposing characteristics (mathematics descending from its unchanging laws versus mathematics arising from people's practices).

As I arrive here, this important question makes its way to this performative space: What type of pedagogy does the epistemology of objectivism promote? On the basis of my experiences as a student, lecturer and teacher trainer, transmissionism is likely to be an appropriate pedagogy serving the nature of *mathematics as a body of pure knowledge*. In my mind, transmissionism promotes the technical interest because it does not seem to provide students with opportunities to communicate about mathematical concepts on their own terms and develop a critical consciousness about the nature of mathematics that they study. Well, some of you (audience, readers) may find my idea of developing a critical awareness about mathematics somewhat ambitious. But I have envisaged that there are various ways of performing it, depending upon the age and grade level of students. For instance, one of my students at the University of Himalaya implemented a project, *Why I don't like triangles!,* for fifth graders with the twin purpose (i) that students be able to understand properties of triangles as a geometric figure, and (ii) that students potentially be critical of the dominance of Euclidean geometry. If the same project was designed for a pre-service teacher he would be able to explore assumptions behind the closed, straightedged-guided, Platonic (pure), *simplistic* and normalised language of Euclidean geometry, thereby envisioning a language inclusive of complex geometric patterns occurring in Nature and our lives (Davis, 2005).

Finally, assumptions about the nature of mathematical knowledge held by an exclusively objectivist epistemology are less likely to account for soulful, elegant, aesthetic, emotional aspects of knowledge generation processes in mathematics (Hersh, 2006). In my experience as a student of mathematics and my study of the mainstream history (that promotes its Eurocentric version, such as Eves, 1990; Kline, 1982) suggests that it can be this epistemology of objectivism that does not help gain insights into how a mathematician (and mathematics student) solves a particular problem or invents a new formulae. If such insights of mathematics students were accounted for in mathematics education the myth of exclusive objectivity would be reciprocated by creative subjectivities, thereby putting emphasis on the view of mathematics as human construction even if it promotes objective epistemology as argued by Glas (2006). ***(curtain falls. the Narrator is walking away from the stage)***

CURTAIN RISES

Act 7: Language of Universality

NARRATOR: ***(stands)*** I am starting this performative detour with a view that the language of universality embedded in the nature of *mathematics as a body of pure knowledge* is less likely to be helpful for harnessing the meaningfulness of mathematics for students' present and future lives. I have used the idea of meaningfulness to emphasise the relevance and applicability of mathematical knowledge in relation to the present and future lives of learners. In my mind, such a language of universality may not be useful to account for the contextualised and emergent lifeworlds and cultural practices which can help students access meanings of mathematical knowledge in a friendlier (to students) and lifeworlds-oriented language. Here, you may think that I am dismissing the use of the universalised language of mathematics embedded in the nature of *mathematics as a body of pure knowledge*. Indeed, I hold the view that universal and contextual languages of mathematics are inextricably dependent upon each other, that the notion of universal language co-arises from the notion of contextual language, *and vice versa*. Here, my critique of universal language is not intended to replace one type of language by the other type, rather it is about creating an inclusive space for harnessing different type of mathematical languages arising from different levels, forms and types of mathematical activities (Rotman, 2006).

(sits) Whilst arguing for an inclusive vision of mathematical language, I have come to realise that an exclusive emphasis on the language of universality embedded in the nature of *mathematics as a body of pure knowledge* often privileges the Western Modern Worldview. Here I have taken the Western Modern Worldview as a collective expression of propositional, deductive and analytical logics, ontology of dichotomy (e.g., *ergo cogito sum*), and objectivist epistemology. In my mind, the ontology of dichotomy depicts this view of reality (or being): *reality is divided into two disjoint and contrary attributes and we need to choose one of the two*. With this view of ontology, an exclusive emphasis on universal language embedded in the uni-dimensional nature of mathematics can harbour many unhelpful dualisms, such as universal versus contextual and pure versus impure mathematics. It is my heartfelt view that such dualisms are likely to be the source of the exclusive view of mathematics education as a subject for a select few.

In my experience as a part-time lecturer, an important feature of an exclusive emphasis on the universalised language of mathematics is its bureaucratisation. The idea of a bureaucratic genre or language represents a highly specialised and rigidly structured language of mathematics which may not help students to realise the usefulness of mathematics in their present and future lives. Here, I am talking about the disempowering posture of bureaucratic language in the context of school mathematics education and mathematics teacher education programs of Nepal. Reflecting upon my experiences as an undergraduate student, I have come to believe that an exclusive promotion of bureaucratised language prevents students from having the fullest possible access to meanings of mathematical concepts included in the curriculum. Speaking from the Habermasian perspective of knowledge constitutive interests[23], I hold the view that bureaucratic language promoted by the nature of *mathematics as a body of pure knowledge* is less likely to promote constraints free communicative situations as many students still struggle to understand the nexus between universalised language of mathematics and its relation with their lived reality. You may think that I am making a case here for replacing the bureaucratic language embedded in the nature of *mathematics as a body of pure knowledge*. However, I hold the view that rather than promoting exclusively the bureaucratic language (or mathematised language), we need to recognise the usefulness of demathematised languages (folk, everyday) in making mathematics accessible to many, if not all, students (Jablonka & Gellert, 2007). ***(stands and walk around)***

(stands with the support of the wall) In my experience as a part-time lecturer (based on the story, *Experiencing A Fractured Worldview III*), an exclusively prescriptive language is another key feature of the universalised language embedded in the nature of *mathematics as a body of pure knowledge*. Do you think that a prescriptive language can facilitate teachers to establish connections between the mathematics of the textbooks and the mathematics of everyday life? Recollecting my experience as

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[23] According to Habermas, the notion of interest (in knowledge constitutive interests) is different from the commonsense notion of interest that is dependent upon desire or inclination of some sort. The notion of interest here entails human ability to pursue goodness or wellbeing through reasoning.

an undergraduate student, I have come to realise that a prescriptive language is less likely to be inclusive of everyday lived reality because it hardly ever makes reference to emergent lifeworlds whilst illustrating mathematical concepts and theorems. If such a language continues to dominate the landscape of mathematics education in Nepal, how can we expect school mathematics education to promote contextual and creative uses of mathematics that are essential for enhancing mathematical literacies among Nepali students? ***(curtain falls. the director announces that there will be an unexpected break of ten minutes as they need to replace a plank of the floor of the stage. people in the audience start chatting. stage light is on)***

CURTAIN RISES

Act 8: Logic of Certainty

NARRATOR: ***(sound effect, deep meditational sitar music is on. pastes a poster on the wall. stands next to the table)*** Recollecting my experiences as an undergraduate student that are not specifically mentioned in the story, I have come to realise that we (myself and other students of our mathematics group) were repeatedly said to be certain about the power of mathematical proof and its underlying logic. And, the key mantra that was repeatedly played was: *'logical thinking' takes us to the 'holy grail of certainty.* If we demonstrated some signs of confusion whilst copying teachers note from the chalkboard, we would be bestowed with yet another mantra: *Follow logic, all doubts and confusions will go away and you will be certain* as if logic is some kind of god or demigod, as ironically presented in the poster, *Syllogisms* ***(points to the poster, Syllogism)***. In this context, I envisage that the notion of logic seems to be conceived as a narrow system of reasoning based on propositional (declarative, non-ambivalent style of representation), deductive (general laws-driven but not arising from particular examples), and analytical (dichotomy and duality-driven) reasoning. Nevertheless, I do not think that following the so-called logic of certainty helped me resolve my confusions. There are instances when I was not free from confusions and doubt about the theorem that I had proved, even though I

If humans are mortal, then should die.
Humans are mortal.
Therefore they should die.
Symbolic expression:
1. $G \Rightarrow W$
2. W
3. $\therefore$ W

Syllogism

produced 'valid' proofs of many theorems of calculus by following prescribed conventions. Unsurprisingly, I find Reuben Hersh say that some notable mathematicians invented and proved many new theorems but did not believe with certainty in their own proofs and kept mum about it until they were convinced by their logic of proof. Perhaps, if I had known that mathematical logic is not the sole basis for attaining surety about mathematical proof then I might have searched for other creative avenues for developing meaningful (heartfelt, creative and imaginative) understanding of mathematical proofs.

(stands) The first logic of certainty that I encountered in my life as a student of mathematics is propositional logic. I envisage that propositional logic un/wittingly promotes a narrow view of mathematical representation in which statements should always be written in a declarative way. Reminiscing about the way that I reproduced proofs for theorems in *Algebra* and *Calculus*, I remember that there was no possibility of probabilistic (ambivalent, open to multiple interpretations) statements. This tendency of precluding ambivalent and perspectival statements and promoting exclusively declarative statements is similar to what Ilya Prigogine calls a faulty reasoning (he refers to the notions of entropy and the arrow of time) aimed at attaining unattainable certainty.

(walks around and sits) My initial encounter with deductive logic was like completing a puzzle that required me to write the magic statement in the conclusion part of the syllogism with two premises: first premise as a general law-like statement, second premise as a particular example and the two premises precede the conclusion. Whist applying it for generating mathematical proofs and solving algorithmic problems, deductive logic served the purpose of mechanising the process of proving theorems or solving algorithmic problems as if no 'human' is required to complete the proof or solution. Although I could prove theorems and conjectures correctly, my struggle to understand those theorems was far from over. Given this experience, I envisage that the exclusive use of deductive logic arising from the nature of mathematics as a body of pure knowledge is likely to: (i) develop a disempowering view of mathematics as if it is guided by a handful of laws and formulae, (ii) preclude much-needed emergence and openness in the teaching and learning of mathematics, and (iii) turn students into muted followers and reproducers of pre-given mathematical laws, rather than being contextual, critical and holistic thinkers and problem solvers. ***(walks around and sits)***

I cannot remember, from a naive realist perspective, when I first encountered analytical logic, which I believe to be yet another thinking tool arising from the nature of *mathematics as a body of pure knowledge*. Nevertheless, analytical logic has taught me un/wittingly to disassociate my literary, interpretive and poetic sensibilities from my 'doing' of mathematics as if these sensibilities would bring undesirable uncertainties to it. In my mind, a narrowly conceived logic has often been used as a means for promoting the logic of 'either or' in which reality is constitutive of two disjoint opposites thereby privileging one of those opposites. In my mind such a logical approach seems to bring certainty to mathematical methods by reducing reality or phenomenon or events into two opposing poles, thereby avoiding any possible indeterminate space or region constructed in between the two extreme poles. By privileging the logic of if-you-are-not-with-angel-then-you-must-be-with-devil arising from the nature of *mathematics as a body of pure knowledge*, mathematics education in Nepal is likely to (i) discount the use of inclusive, non/dual pedagogical approaches in mathematics teaching, and (ii) promote a decontextualised view of mathematics education by not allowing contextual multiplicities.

(stands) I have discussed various dimensions and pedagogical implications of these logics in the upcoming sections (see Sections Three and Four). In Section Three, I have discussed the relationship between these logics and reductionism prevailing in the field of mathematics education in Nepal. Section Four explores key features of these logics in relation to their pedagogical implications for mathematics education. Here I want to clarify my position that I am not being dismissive of any of these logics. Perhaps, these logics are useful to account for one aspect (i.e., depicted by the nature of *mathematics as a body of pure knowledge*) of mathematics. My heartfelt view is that this unidimensional nature of mathematics is not sufficient to fulfil the purpose of enhancing multiple mathematical literacies because it may not incorporate various forms of mathematics that are necessary to fulfil this purpose. In this situation, these three conventional logics are less likely to be helpful for accounting for both the certain <u>and</u> uncertain nature of mathematics. Don't you think that one cannot be certain without knowing what uncertainty feels and appears like?

In this way I have come to know that an exclusive emphasis on the *nature of mathematics as a body of pure knowledge*, which I have experienced as a student, lecturer, teacher trainer and teacher educator, is not helpful for conceiving an inclusive vision of mathematics education in Nepal. It is my sincere view that by having the nature of m*athematics as a body of pure knowledge* as the only orienting framework of school mathematics education and mathematics teacher education we may not be able to (i) conceive mathematics education as an inclusive enterprise, (ii) promote agentic (participatory) pedagogies that cultivate learners' creativities, and (iii) provide students and prospective teachers with choices of different forms of mathematics useful for their present and future lives. ***(greets the audience with Namaste. leaves the stage . curtain falls)***

People in the audience take a break for tea and coffee. in the meantime, the Director makes an announcement: the next episode starts in fifteen minutes.

EPISODE II (OR CHAPTER 2): NOR IS THE NATURE OF *MATHEMATICS AS IMPURE KNOWLEDGE* INCLUSIVE

CURTAIN RISES

Act 1: Experiencing a Fractured Worldview IV

***STORYTELLER**: **(sound effect, meditational music, is played. stands)** It can be any weekday in the fourth week of July 2003; I am in the SMEC[24] Masters Students' Room, next to the temporary Carpark situated at the southern end of the university. I am alone in the room, waiting for a friend to visit me. The July morning is unusually warm, creating a disbelief in our patterned mind that Nature is acting weirdly. Nature does not seem to follow man's formula, norms, patterns and graphs, instead She appears to follow her own will. Thinking in this way, I open the computer that has been serving me since the beginning of 2002, and look for the 'I' drive for my recent writings. In the meantime, the numbered 'one' item of my 'to do list' pasted on the study table reminds me that I have to finalise my slides, stories (data texts) and a paper for the upcoming WAIER[25] presentation. As the cursor moves from one to another directory, someone knocks on the door. I open the door and it is my friend Ramesh who has been doing a Masters in Information System Science[26] since the first semester of 2003.*

"How are you, Ramesh-ji? By now you might have been familiar with the university system. First Semester is always a struggle for international students," I say this to

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[24] Science and Mathematics Education Centre, Curtin University of Technology

[25] Western Australia Institute of Educational Research (see, http://www.waier.org.au/)

[26] Pseudonym of a discipline within the Business School.

Ramesh because he has shared his problem of understanding lecturers at the beginning of this year.

"Thanks, I am alright. Yes, now I can understand every lecturer without any difficulties. Indeed, everything is going well with me now. How is your project work going? By the way what is your research about?"

"It is going well. I prepared a proposal last semester and I am going to implement it this semester. Actually, I have already started it," I pause here, not intending to unpack many unconventional[27] *ideas embedded in my research in the first conversation.*

"What is the topic of your research, or research problem that you are addressing?," Ramesh repeats the question and shows his keenness in knowing more about my research.

"I am inquiring into the decontextualised nature of mathematics education in Nepal. In so doing, I am aiming to come up with some perspectives that can help change the pure, Western and Modernist mathematics to a local, culturally contextualised mathematics in our school and teacher education," I say rhetorically and Ramesh's face reflects that he is hearing something outrageous.

"How is it possible, BalChandra-ji? I am not a 'mathematics major' student but I have also done some mathematics units during my university education. I have never heard of something like this. How is it possible to change the existing Western mathematics by local mathematics? It is also surprising for me to hear that mathematics can be 'cultural'. My mathematics professor, back home, always insisted that mathematics is above culture and it cannot be affected by any culture," Ramesh speaks as if his belief system is shattered, his secure ground has been shaken.

"Ramesh-ji, everything is cultural and so is the Western mathematics. It has been imposed upon us in the name of culture free mathematics. I know where you are

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[27] My MSc project used an autoethnography together with a number of theoretical referents, including radical constructivism, curriculum and Ethnomathematics (Luitel & Taylor, 2007)

coming from. I know where you are coming from. We have been unwittingly colonised by the hegemonic thinking that mathematics is exclusively culture free, abstract and context free. Indeed, mathematics is man-made and it has been changing in accordance with the change in human consciousness. The idea that mathematics is unchanging, infallible and certain is not wholly true. In my view, that mathematics is culture free, that mathematics is pure, and that mathematics is certain are politically motivated perspectives which give the basis for excluding mathematical knowledge systems embedded in people's practices from the school curriculum," I finish my protest speech and grab some papers from the adjoining printer.

"Well, BalChandra-ji I am not an expert in mathematics. My mathematical knowledge is limited within my area of study. You seem to be well focused toward disproving the value of pure mathematics. And, you also have studied mathematics as a major subject. By the way, do you think your culturally contextualised mathematics will be recognised by your colleagues? What does your culturally-oriented mathematics look like then?," Ramesh curiously asks, as another student enters the room and makes his way to one of the other computers available in the room. In my mind I am declaring a rage as mentioned in this poem. ***(points to the poetic poster, Let Me Declare, hung on the wall)***

Let Me Declare

Let me declare
From today and further
I change my direction
I challenge conventions
I walk on the fire
I dance on the water
I go totally wild
I fly opposite to the wind
Let me declare

Let me declare
This rage does not stop here
It travels on sand and water
It reaches to the ether
It creates a cyclone
It organises a hurricane
It sacrifices ignorance
It destroys borders

Let me declare
In this rage, singular becomes plural
Here turns out to be there
The rebellion alters many
Nothing is big and tiny
Rivers pass through desert
Vultures turn away from meat
Mice take charge of the cheese factory
Cats take care of rat zoos
Lions embrace compassion

Let me declare
From now and hereafter
I host a *tandav* dance
with lots of free entry tickets
You can access the inaccessible
You can think the unthinkable
Don't miss this opportunity
Look inside you and allow it entry
This is my final declaration
The rage has just begun

"Here, I am using an anti-foundational view in my research that says: mathematics is a contingent and fallible label constructed via the cultural process of identifying,

representing and explaining some particular domains of human experience, such as quantity, shape, size, pattern, relation and position. Mathematical ideas are not pre-given external truths; rather they are always negotiated via our social, personal and individual mediative processes. If we are to fully realise mathematics as impure knowledge then we need to stop celebrating any traces of mathematics as decontextualised, algorithmic and abstract knowledge." I am not sure how much of my rhetoric gets entry into Ramesh's conceptual mesh.

"I don't know much about these philosophical ideas. But I would like to know one thing: How would you teach this type of mathematics?," Ramesh asks yet another question, but shortening his statements this time.

"The conventional pedagogy of hegemonic imposition and transmission does not fit well with the nature of mathematics as cultural and embodied knowledge, rather a totally learner-centred approach that is grounded in the learner's socio-cultural experience and guided by the notion of mathematics-in-making fits well in accordance with this nature of mathematics. In order to fully realise and implement these pedagogical ideals, the prevailing image of education as banking needs to be replaced by an image of education as cultural sustainability which is capable of emancipating learners from the hegemony of foundationalist mathematics by privileging their natal/local cultures as the major source for learning areas as well as the pedagogy of mathematics," I speak in a preacher's way as if Ramesh is my ready-to-be-an-impure-mathematics convert.

(stands. walks around. sits) *Our conversation is diverted now. We have chosen not to discuss any more about my research project, rather we start sharing about the ongoing conflict in Nepal. Although I am determined to promote a 'culturally-oriented view of mathematics', I am not quite sure how I will persuade other teachers and teacher educators to make use of it in their teaching. As I am about to close this storyline, a question comes to my mind: Am I not holding yet another dualistic view that impure mathematics should replace pure mathematics?* ***(slow and soft drumbeat for half a minute. curtain falls. the Director makes an announcement about the next Act)***

CURTAIN RISES

Section One

Act 2: Experiencing a Fractured Worldview V

STORYTELLER: ***(sound effect, a classroom context where a professor is heard asking his students to rote memorise a theorem, is on. stands)*** *It can be any day in the month of April 2006. I am sitting with a group of students of a newly launched teacher education program for secondary school mathematics teachers. These students have come to me to report complaints about the teaching of the tutors of two units: Pure Mathematics I and Pure Mathematics II*[28]*. As the only fulltime staff member belonging to mathematics education, I have been attending to students' complaints and issues that are likely to impede the program from running smoothly.* ***(sound effect out)***

(sits. stands) *As I and students gather around a table, Student 1 speaks up: "Sir, why do you introduce these pure mathematics units, which have no use for improving our teaching and learning. We are not learning anything apart from being taught to rote memorise some arcane theorems, algorithms and definitions."*

Student 1 expresses what I have been thinking about these two units. Actually, I do not want these units to be included in the teacher education program. But, I am not enough to rebel here. Probably, I need to create a cadre-base to challenge the regime of pure mathematics, thereby replacing it by a culturally justifiable mathematics. Whilst thinking of a rebellion, I make notes of what Student 1 has said, and wait for Student 2 to speak.

"You have taught us that meaningful learning always promotes students' active involvement in classroom activities. But the tutors of Pure Math I and II hold the view that learning is only possible through rote memorisation and blind practice. There is no place for discussions and student participation in the classes of these two units."

Now I stop making notes because all of them apparently are reporting the same experience that I had with my undergraduate mathematics lecturers some 12 years ago. It is déjà vu all over again. Inside me, I am really angry, and thinking about

[28] Pseudonyms of two units included in the teacher education program of University of Himalaya.

making a case to replace these two units. An extreme view within me gets strengthened and is determined to dismiss the regime of pure mathematics. I commit to them that I will seek for amicable solution to resolve this standoff and the meeting is over.

Next, I approach the tutors of those units. Both of them are adamant that they are acting according to the spirit of pure mathematics unit. The tutor of 'Pure Mathematics I' even blames me for teaching unmathematical stuff to them. Perhaps, he is referring to my unit on philosophy of mathematics that talks about the cultural, sociological and aesthetic nature of mathematics. Indeed, some of my classes have advocated changing pure mathematics to culturally-aligned mathematics. The tutor of Pure Mathematics II is a little better but he also insists that student participation is almost impossible in his unit because he has to 'cover' the content. Even though I offer him some ways of involving students in their teaching, the tutor is almost inconvincible. Finally, I say to both tutors: "Well, if this is because of pure mathematics, then I need to find ways to replace this type of mathematics by the mathematics that promotes students' active participation. In my imaginative space, I want to write a poem such as the one hung on the wall **(points to the poem, The Reunion)***, inviting these Pure Math tutors to change their worldview. Will they accept my invitation?*

The Reunion

Oh dear friend, wake up now
I will explain how—
You will come out of the confine
And, help me plan for a reunion

That reunion will be dramatised
For those who are tormented
By the wrath of muted symbols
By the command of motorized algorithms

That reunion will play a song
For our survival in the aggression
of a rigid structure over emergent kens
of a confined frame over open musings

That reunion will see dances
challenging the unhelpful fences
uniting the body and the mind
saying no to their undue break

That reunion will hear stories
about Roll's theorem being adapted
about new definitions of Nepali Calculus
to be used by people of all walks

That reunion will see a debate--
inclusive versus elitist mathematics
it helps construct some strategies
ways of addressing many dualisms

After a weeklong consultation, there appear to be a few changes in their 'pure math' classes. However, I am not satisfied with this incremental change. And, I do not buy into the idea that all these students are not capable of learning mathematics. Later in *the evening, I make this journal entry after a weeklong emotional suffering: "Well, I need to replace these two units. Pure mathematics is not helping our students to understand the power of mathematics. We are aiming to produce teachers who can transform the hegemonic landscape of mathematics education caused by the widespread view of mathematics as a body of infallible and unchanging knowledge. But these two units are not helpful in this endeavour. I want these units to be scrapped, replaced and totally altered. What can be an empowering alternative of pure mathematics? Perhaps, it can be impure mathematics that promotes nothing but our own cultural capital!"* ***(sound effect: a local musical instrument, narsinga (horn) is played to mark the end of this Act)***

CURTAIN RISES

Act 3: Prologue

NARRATOR: ***(sits on the chair and stands)*** Let me start this performative detour with the notion of a 'border crossing' to represent my shift in thinking about the nature of mathematics that I have embraced in recent years (between the years 2003 and 2006) (Giroux, 1992). Representing slices of my life as a researcher and a teacher educator, the stories, *Experiencing A Fractured Worldview IV* and *V*, portray contexts and conditions under which I embraced the nature of *mathematics as impure knowledge*. I have taken the image of the nature of *mathematics as impure knowledge* to depict a number of types of mathematical knowledge systems arising from people's lifeworlds. In order to facilitate my performative journey of inquiry, I am going to use these types: embodied, *informal*, ethnic, artefactual and communal, to represent attributes of impure mathematics as knowledge systems arising from people's cultural practices. The notion of embodied knowledge entails the view that mathematics is blended in, and arises from our body-mind complex. It can be this genre of mathematics that accounts for intuitive, implicit, soulful, metaphorical and artful mathematical knowledge (Nuñez, 2006). Similarly, the notion of *informal* mathematics is associated with mathematical practices that do not have a rigid structure as compared with formal mathematics (D'Ambrosio, 2006). This type of mathematics appears to be used in the context of 'everyday problem solving' in our lifeworlds with an emphasis on emergent, contextual mathematical thinkings. The idea of ethnic knowledge can be articulated as specific mathematical knowledge embedded in the practices of certain ethnic groups (Gerdes, 2006; Rosa & Orey, 2007). For example, ethnic Tamangs of Nepal have a unique number system, geometric patterning, category of sets. The idea of artefactual mathematics entails mathematics which is inscribed and preserved in the cultural artefacts (or designs) constitutive of people's practices (Eglash, Bennett, O'Donnell, Jennings, & Cintorino, 2006). Such artefacts can include a broad range of physical and virtual objects, such as sculptures made by the ethnic Newari people of Nepal. The idea of communal mathematical knowledge can represent a vast array of shared mathematical practices of communities identified via a shared language, geographical location and cultural values (D'Ambrosio, 2006; Gutstein, 2006, 2007).

(sits) I want to say that these classifications are not intended to be full, final and exhaustive, instead they are taken to represent heuristic categories that can somehow clarify possible mathematical genres referred to by nature of *mathematics as impure knowledge*. I have chosen ethnomathematics to be a key basis for this classification following D'Ambrosio's (2001; 2006) notion of ethnomathematics as mathematical knowledge systems arising from occupational and cultural practices of people. It can be during the period of 2003 and 2006 that I was influenced by the view that ethnomathematics-inspired impure mathematics is the sole liberator from the widespread hegemony of pure mathematics, although the term, 'impure' is my recent construction intended to represent the anti-'pure mathematics' view embedded in my perspective. Apart from using some ethnomathematical classifications, I also envisage now that the label of impure knowledge can be a useful label for incorporating heretic proofs and definitions belonging to the domain of mathematics. Thus, although my heuristic label of 'impure mathematics' can refer to both genre and process which promote transgressive and unorthodox epistemologies and pedagogies of mathematics, my key focus of discussion here is based on the image of impure mathematics that encapsulates some of my professional activities between 2003 and 2006.

Whilst believing that aspects of the nature of *mathematics as impure knowledge* is a helpful referent for challenging the widespread hegemony of *pure mathematics*, I have come to realise that an exclusive emphasis on the nature of *mathematics as impure knowledge* can also be hegemonic if it rests upon a narrow view of culture as an unchanging phenomenon. An extreme emphasis on the static aspect of culture may serve as a referent for ethnic segregation and tribalism by forcing people to 'stay' within their own cultural/ethnic worldview. Furthermore, I envisage that using exclusively one particular label (be it pure or impure) to represent the entirety of the nature of mathematics also can be hegemonic because such a label may not offer diverse possibilities for conceiving an inclusive vision of mathematics education. ***(stands. walks around and sits)*** Last but not least; I feel that the use of new dualism of impure (versus pure) mathematics to protest the old dualism of pure (versus impure) mathematics may not be fully helpful for conceiving transformative visions of inclusive mathematics education. Here my notion of a transformative vision includes perspectives that help teachers and students think beyond in/visible structures and frameworks embedded in their thinking and actions. Given these ideas, I elaborate the notion of culture, hegemonic-metonymic label, and dualistic thinking that could have been embedded in my earlier attempt to conceive the nature of *mathematics as impure knowledge*. ***(curtain falls. the Narrator is still on the stage. some people in the audience change their seats)***

CURTAIN RISES

Act 4: Potentially a Disempowering Notion of Culture

NARRATOR: ***(appears in a Nepali traditional dress. stands)*** Arriving at this performative detour, I am starting with this question of our time: What would be your possible responses if you are asked about the concept of culture? Perhaps, I respond to this question in three ways (Baldwin, 2006). First, the idea of culture can be equated with traditional artefacts, ritual procedures, race, ethnicity and religion, which are used to represent the image of culture as an unchanging and stable entity or thing. Second, I can say that culture is an ever-changing construct, like a chameleon. By this view, I am referring to the microcosmic aspect of culture in which every group or individual can be seen as entities changing and shifting forever. My third response is likely to incorporate dynamic relationships between the constant change of culture at the micro level and some degree of stability at the macro level, thereby conceiving myself as a cultural being situated at the dynamic meso level. Indeed, the idea of change does not make sense alone without the idea of stability. Thus, my third response can depict an holistic concept of culture as a dialectics of change and stability. Whilst reading my stories, Experiencing A

Fractured Worldview IV and V, I have come to realise that an exclusive emphasis on impure mathematics may give a sense of the static notion of culture. I envisage that such a view is associated with the notion that ethnomathematics (which accounts for mathematics arising exclusively from one's own culture) is the only answer to the Westocentric and Eurocentric hegemony in mathematics education (Powell & Frankenstein, 1997).

I would like to invite you to participate in a thought experiment by responding to this question: *What would happen to mathematics education if the notion of culture as a static and unchangeable entity became hegemonic?* I envisage that such a view can deprive learners of making informed choices that would be offered by different forms of mathematics, and that would help improve their present and future lives. My notion of choice is about providing students with opportunities to interact with different forms of mathematics, thereby being able to use mathematics creatively in their present and future lives. Thus, rather than being a source of empowerment, the static notion of culture often harbours rejection and repression, thereby serving a reproductionist agenda in mathematics education. In my mind, such a static (and fundamentalist?) view of culture can be misused by cultural essentialists to create a repressive regime that does not abide by the norms of democratic participation, basic human rights and individual creativities. More so, it can be an essentialist view of culture that gives rise to unhelpful labels of places and people, such as Dark Africa, Exotic Nepal and Oriental East (Ashcroft, Griffiths, & Tiffin, 2000). Such a romanticisation can often be read as a deep-seated belief that these cultures are ever incompatible with 'normal' cultures. Yes, some degree of romanticisation can be useful for creative thinking inasmuch as the romanticisation is informed by critical reflexivity, an epistemic referent for questioning our potentially disempowering and invisible subjectivities, beliefs and ideologies.

I hold the view that if one's own culture (and its particular form, such as undistorted, pure, natural) becomes the only frame of reference then it is likely that learners will not be able to develop much-needed critical awareness of the boundary conditions existed of their own cultures. Similar to conventional-minded researchers (e.g., Horsthemke & Schafer, 2007; Rowlands & Carson, 2002) who seem to have developed an uncritical view of the disempowering posture embedded in the nature of *mathematics as a pure body of knowledge*, some ethnomathematics-inspired educators (including myself during the period of 2003 to 2006; Gerdes, 1998; Powell & Frankenstein, 1997) seem also to follow suit by not considering the importance of algorithmic, abstract and *formal* mathematics, and by not examining how one's own culture can be disempowering because of many invisible structures and unexamined assumptions. I realise now that such an endeavour of creating dualities is unhelpful for promoting a transformative vision because they promote yet another language of exclusion (e.g., Western versus non-Western). In my mind such dualities seem to enforce simplistic boundaries between embodied <u>and</u> disembodied, *formal* <u>and</u> *informal*, civilised <u>and</u> primitive, and abstract <u>and</u> concrete, thereby creating unjustifiable textual labels which may not be helpful for conceiving reflexive, interactive and effectual relationships between sometimes opposing attributes of our socio-cultural realities (Gergen, 1995). If we are to fully embrace culture as a referent for creating inclusive visions in mathematics education, we cannot use the same old system of thought that subscribes to many unhelpful dualisms. In a nutshell, I am not prescribing that we should forget these boundaries at all; rather I am persuading you to be critical of the posture that they are fixed, *real* and natural.

An unhelpful situation arising from the exclusive promotion of the nature of *mathematics as impure knowledge* is a narrowly conceived view of cultural sustainability as reproducing Nepali culture without being critical of its possible disempowering features. Such a view of cultural sustainability may prevent learners from being aware of their creative possibilities which can help renew the culture. In my mind cultural sustainability is not about blindly reproducing the entirety of a culture, rather it is about exploring creative and agentic ways of renewing it as per the needs and aspirations of changing times. I argue here that an exclusive reproductionist view becomes synonymous with cultural sustainability when the culture is conceived to be an unchanging structure separated from individuals, just as Horsthemke and Schafer (2007) regard African culture as unchanging and separated from what happens in school mathematics education whilst arguing for Western (perhaps pure: algorithmic, abstract, culture-free) mathematics. In a similar vein, Gerdes (1998) makes a case for an Africanised mathematics (perhaps impure: embodied, artefactual, *informal*) with the emphasis on an essentialist African culture. In a nutshell, my worry is that a narrowly conceived notion of culture is less likely to promote reflexive-interactive relationships (acts of looking at self-premises through a critical gaze) between self and other, person and group, *production* and *reproduction*. ***(curtain falls. the Narrator is still on the stage. the Director makes an announcement that the next Act will start in a moment)***

CURTAIN RISES

Act 5: Yet another Metonymic Hegemony

NARRATOR: ***(stands. bows. sits)*** On the one hand, the nature of *mathematics as impure knowledge* has been a means for contesting the hegemony of the widespread metonymy of mathematics as an exclusively culture-free, abstract and infallible subject. On the other hand, subscribing exclusively to the nature of *mathematics as impure knowledge* may cultivate yet another restrictive metonymy that does not account for the holistic and multidimensional nature of mathematics. Here, I have used the notion of metonymy to depict the longstanding (mis)representation of the entirety of any educational idea through a label that depicts a particular aspect of the idea. Needless to say, metonymic representations have a tendency to highlight an apparent object or aspect of an object to denote something bigger than what it already is (Lakoff & Johnson, 1980; Willison & Taylor, 2006).

In what ways may the metonymy of impure mathematics be hegemonic to mathematics education in Nepal? This question reminds me of Shankara (a sixth century philosopher of non-dual Vedanta, a Vedic philosophical school) doubting the partiality embedded in the representation of everyday reality which, for him, does not allow us to realise the ever-present Oneness (Wood & Sankaracharya, 1974). Furthermore, Nagarjuna's (a third century Buddhist Philosopher who is believed to have been the pioneer of the Middle Way in Buddhism) critique of metonymic label-generated essentialism as not being useful for depicting the much needed realisation of the interconnectedness between sometimes opposing attributes reminds me of the narrowness embedded in any form of metonymy, including the metonymy of pure mathematics. Shankara's Oneness can be used as a metaphor of inclusion, structural dissipation and creative openness, taking back to our natural state of no-separation. I doubt that the label of 'impure mathematics' takes me this far, as it may promote a similar type of hegemony to that which has been sponsored by the nature of *mathematics as a body of pure knowledge*.

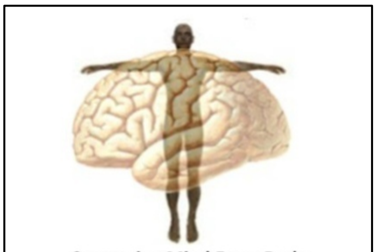
(stands) Although I envisage the nature of *mathematics as impure knowledge* can be a powerful referent for challenging the widespread view of the nature of *mathematics as a body of pure knowledge* that has been sustained through colonisation and imperialism (D'Ambrosio, 2006), replacing one uni-dimensional nature of mathematics by another with similar features (in terms how it is or is not inclusive of sometimes opposing views) is likely to promote an exclusive vision of mathematics education in Nepal. My notion of uni-dimensionality indicates a situation in which mathematics education is locked inside a singular framework of the view of mathematics as portrayed by the poster, *Hegemonic Frame* ***(points to the poster hung on the wall)***. Thus, rather than creating a space for co-existence and interaction, the exclusive celebration of the label of *impure mathematics* may promote a static space that is likely to prevent the much needed multidimensional nature of mathematics from being accounted for when conceiving a transformative vision of inclusive mathematics education in Nepal.

Speaking from a language-games perspective (Fleener et al., 2004), I find that the metonymy of *mathematics as impure knowledge* promotes one type of ‘life form’ that is less likely to account for ‘life forms’ other than those embedded in impure mathematics. Here the notion of life form is taken to depict inseparable relationships between language labels and lived reality, meaning that language labels are constitutive of reality (perceptions of and actions upon which give rise to different life forms). What type of life form is likely to be generated by the label of impure mathematics? Perhaps, it envisages life forms that are grounded in an exclusive celebration of relativism which often denies the existence of transcultural and intercultural life forms. I am not saying that relativism is necessarily bad; rather I hold the view that the hegemony of relativism tends to deny non-relativistic forms of life (e.g., having common views of morality and ethics in relation to human rights). Furthermore, by using a singular life form, students are likely to be prevented from being empowered to imagine holistically because of the uni-dimensionality of the metonymy of *mathematics as impure knowledge*. ***(curtain falls. the Director makes an announcement that another Act will be launched in five minutes)***

CURTAIN RISES

Act 6: Unhelpful Dualisms

NARRATOR: ***(stands. grabs the poster, Separating Mind From Body, and pastes it on the wall. sits)*** Arriving at this stage I would like to raise this question of our time: Can we transform the exclusive view of mathematics as a subject for a select group of students to an inclusive learning domain by replacing one form of dualism by the other form of it, such as replacing pure by impure mathematics? For me, the idea of dualism is the tendency to divide the world, or human experience, or phenomena, into two contrasting/exclusive opposites, thereby privileging one particular constituent of the opposites as in this poster ***(points to the poster, Separating Mind From Body)***. As I discussed in earlier paragraphs of this episode, the nature of *mathematics as impure knowledge* is also likely to give rise to a number of unhelpful dualisms, such as impure versus pure mathematics, relative versus non-relative knowledge, anti-foundationalism versus foundationalism, student-centred versus teacher-centred pedagogy, and 'my culture' versus 'their culture'. For me, the dualism of impure (versus pure) mathematics may slightly improve the situation by opening up yet another equally credible image of mathematics and its slightly liberating epistemologies and pedagogies, but adherents may be locked in a world of false consciousness as a result of a new form of hegemony (Habermas, 1989). Given these perspectives, let me articulate possible dualisms that may arise out of the nature of *mathematics as impure knowledge*. ***(stands. sits)***



Separating Mind From Body

I argue here that the duality of impure (versus pure) mathematics is likely to delimit students within their own socio-cultural world (i.e., relative world). Whilst arguing for an empowering relativism that helps students realise the need to embrace multiple forms of mathematics, I am always reluctant to accept that narrow relativism (that promotes restricting students within their own time-space without offering any other choices) is the only way of seeing the world. Situating mathematical competences only within their natal-cultural worldview can prevent learners from being open to the world outside of their cultural reality. In this situation, learners would become alienated from conventional mathematics (i.e., *mathematics as a body of pure knowledge*) and lose access to empowering social choices which conventional mathematics can also offer (Vithal & Skovsmose, 1997). Similarly the situation of relativism taking over non-relativism (sic) is not much different from universalism taking over non-universalism (sic). Indeed, such a prevailing dualism does not help conceive a much needed inclusive view that universalism and relativism co-exist side-by-side in the same phenomena.

(stands) In my story, *Experiencing A Fractured Worldview V*, I have envisaged anti-foundationalism to be a key feature of the nature of *mathematics as impure knowledge*. At that time, I did not hold the view that foundationalism and anti-foundationalism are interrelated, and that they exist through reflexive, interactive, co-dependent relationships. Here, foundationalism is a view that everything is interrelated and based on some unchangeable premises, whereas anti-foundationalism is the denial of a unified whole in which there are some core binding beliefs. Of course an extreme view of foundationalism is always unhelpful. Does not the same view apply to an extreme form of anti-foundationalism? In my mind we cannot conceive faith (foundationalism) without some degree of doubt (anti-foundationalism) (Hopp, 2008). If we are to doubt everything in an extreme sense, then it is almost impossible to 'inhale' and 'exhale' every other second. Thus, creating a duality between these two is to deny the inclusive vision of mathematical knowledge as a dialectics of belief and doubt. Indeed, anti-foundationalism appears to be arising out of foundationalism, and *vice versa*.[29] Although I agree with the view that the hegemony of foundationalism has given rise to a Euclidean geometry-inspired uni-dimensionality, I do not also subscribe to the view that replacing foundationalism by yet another uni-dimensionality of anti-foundationalism brings inclusiveness to mathematics education. What will happen if anti-foundationalism becomes the sole reference of mathematics education in Nepal? Perhaps, the school

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[29] Or I say it this way: I don't *really* know in an absolute sense that meanings of foundationalism and anti-foundationalism are so secure and eternal as defined by philosophers of science and mathematics. It may be the case that these conceptual labels hold true for a certain simplistic cognitive level and they may not be able to account for complex situations in which belief and doubt co-exist and operate interactively.

mathematics curriculum of Nepal will throw away 'formalist algorithmic' and Platonic idealistic mathematical knowledge, thereby limiting it to an unstructured (or de-structured) and locally emergent mathematics. Yes, de-structuration is needed but not at the cost of turning anarchism (inspired by narrow libertinism) into another hegemony.

(sits) Reflecting upon my roles as a teacher trainer and teacher educator, I began to advocate student-centred pedagogy in mathematics education after I started working as a teacher trainer in the University of Himalaya. In my role as a researcher who wanted to dismantle the widespread hegemony of pure mathematics, I continued to promote this somewhat dualistic view that an empowering pedagogy should always be student-centred. Well, there can be several meanings of student-centred pedagogy, but I conceived this notion to be understood as synonymous with libertinism in the classroom. Now, I envisage that such an idea of student-centred pedagogy can be misleading if the empowering role of the teacher is also dismissed, and because of which mathematics teachers are likely to be wronged. I argue here that the dualism of teacher-centred versus student centred pedagogy is not helpful to conceive the view that these two forms of pedagogies interact and inform each other in the process of pedagogical enactment. Is it possible to imagine a pedagogy without any role for teachers? Yes, we may find individuals who have acquired knowledge and perhaps awakened without any physical form of a teacher. Nevertheless, the wisdom traditions of the East (and perhaps of the West) talk also about our own teacherly instinct that helps us know and awaken from moment to moment (Hirst, 2005; Upadhyaya, 1997). Furthermore, the Vedic literature on guru-disciple relationship sheds light on the non-corporeal consciousness and non-human life-form as teacher, as well (Hirst, 2005; Patel, 1994). In a nutshell, my intention is not to reject the agentive dimension embedded in student-centred pedagogy, rather I am critical of the potential misinterpretation of any linguistic label that might be taken as natural and that could not be able to capture a much needed transformative pedagogical vision in which teachers' roles are immense.

Indeed, this brief discussion of disempowering features of dualism has been expanded in Section Two. In that section, I have explored multiple meanings of dualism that occur in the pedagogical landscape of mathematics education, thereby offering ways to overcome them. With this clarification, I would like to end my performance of this Act now.

(curtain falls. a musical instrument, Damaha (a Nepali drum) produces slow drumbeats for half a minute. stage light is on)

(curtain is still unopened. the Director can be heard speaking from behind the curtain)

Dear Audience,

Although the nature of mathematics as impure knowledge helps us challenge the widespread view of mathematics by itself, it appears to be unhelpful for promoting an inclusive and agentive mathematics education in Nepal. Perhaps, the performances of the previous two Episodes might have helped us realise that embracing a uni-dimensional view of mathematics is less likely to give rise to an inclusive vision for mathematics education in Nepal, rather it continues to reproduce the circularity of metonym, duality and essentialism. Can there be an outlet to an holistic perspective? Let us refresh our journey together by exploring different forms of dialectics which possibly can help us generate a multidimensional image of the nature of mathematics. Please wait for another ten minutes as we need to make sure that everything is in place for the upcoming episode.

EPISODE III (CHAPTER 3): MATHEMATICS AS AN IM/PURE KNOWLEDGE SYSTEM: AN EMPOWERING VISION FOR INCLUSIVE MATHEMATICS EDUCATION

CURTAIN RISES

Act 1: Prologue

NARRATOR: ***(stands)*** Let me start this performative episode with this popular aphorism arising from the Vedic cultural tradition: *It is not the language but the speaker that we want to understand*. I take this view as a referent for connecting these performative texts with my values and beliefs that help the audience to understand me as a teacher educator, as a performer and as a researcher. More so, this performance is about me as a conscious (possibly) person who wishes to transform the widespread hegemony of the nature of *mathematics as a body of pure knowledge* to an inclusive nature of *mathematics as an im/pure knowledge system*, where the qualifier, im/pure, is designed to represent an inclusive space for both *pure* and *impure* mathematics. Moreover, this performative episode is the culminating reflection of me as student, teacher, teacher educator and researcher, all of whom have experienced the unidimensional nature of *mathematics as a body of pure knowledge* and its pedagogy of 'ruthless' transmissionism. Therefore, I urge the audience to regard my voice as a combination of different layers (for instance, personal, cultural, emotional, social) of my being, as opposed to a set of sounds separated from my body-mind-context complex.

By emphasising the performer's self over decontextualised texts, symbols and alphabets, this episode progresses with three key *Acts*. In the first Act, I elaborate different forms of dialectical logic (or dialectics) arising from Hegelian, Eastern Negative, Adorno's Negative and Integral perspectives. In constructing a summary of these different types of dialectical logic, I explore their key characteristics for conceiving a much needed inclusive and multidimensional image of the nature of mathematics. The second Act embodies my vision for transforming the dualism of pure versus impure mathematics to an inclusive vision of im/pure mathematics. In this process, I elaborate how I have come to conceive the label, 'im/pure', to be inclusive of both 'pure' and 'impure' mathematics. In the third Act, I explore ways in which the notion of knowledge system becomes more inclusive than the notion of a body of knowledge. In the same Act, I aim to generate some visions about translating the multidimensional nature of *mathematics as a body of im/pure knowledge* system into inclusive visions for mathematics curriculum, agentic pedagogy and authentic assessment. ***(curtain falls)***

CURTAIN RISES

Act 2: Exploring Different Forms of Dialectical Logic

NARRATOR: ***(stands. greets with Namaste. sits)*** With a passion for envisioning an inclusive mathematics education in Nepal, I am about to explore different forms of dialectical logic as a means for developing an image of the multidimensional nature of mathematics. In my mind, these different forms of dialectical logic (or dialectics) are rooted in and have evolved through different cultural, philosophical and wisdom traditions. Developing a common idea of dialectic as an holistic and inclusive approach to reasoning, I am exploring Hegelian dialectics, negative dialectics in Vedic-Buddhist traditions, Adorno's negative dialectic and integral dialectics. Rather than claiming to have presented a comprehensive definition of these dialectics, I have discussed aspects of these dialectics which can be useful for developing an inclusive vision for mathematics education in Nepal. Perhaps, writing in this way I might have committed some degree of imaginative errors, as I am privileging my voice over anyone else's perspective. ***(stands. sits)***

(a) Hegelian Dialectic*:* When I talk about Hegelian dialectic, you may remember the popular imagery of thesis, synthesis and antithesis of the concept that you are contemplating. This dialectic can also be regarded as a process for attaining an immanent transcendence by getting rid of restrictions and one-sidedness inherent in our thinking (Wong, 2006). So the Hegelian dialectic can be a means for exploring contradictions embedded in the concepts and perspectives that we are carrying forward. Although I am not trying to provide an exhaustive review of the Hegelian dialectic, I prefer to outline three major salient features of the dialectical reasoning propounded by Hegel.

Primarily, I find Hegel used the German term, Aufhebung, so as to depict this process of dialectical reasoning. The verb form of Aufhebung, *aufheben,* together with various qualifiers (e.g., sich gegenseitig, einander, sich) generates these English equivalent meanings: (a) to raise, to lift up, (b) to negate, to destroy, to abolish, and (c) to keep up, to preserve ("German-English Dictionary," 2008). It appears to me that the Hegelian dialectic represents a complex procedure with which not only to negate the concept under study but also to be inclusive of the negation (Giegerich, Miller, & Mogenson, 2005).

The second feature of the Hegelian dialectic is the espousal of dynamic ontology, meaning that each construct, concept and phenomenon are always moving along a non-stopping journey of internal change (Rescher, 2006). Rather than being a lock-step of thesis-antithesis-synthesis, it is an open and creative process by which to generate an holistic understanding of reality. The Hegelian idea of dialectic indicates a movement that leads to the spirit (what Hegel calls the soul of all knowledge) that binds all together (Hegel & Knox, 1967). Literally, the idea of spirit binding all together appears to be similar to the Upanishadic notion of Oneness that makes sense of our being connected to the holistic cosmos.

The third feature of the Hegelian dialectic is the cultivation of transformation through contradictions (as opposed to conflict) without which the Hegelian dialectic may not appear different from other forms of dialectics. I have come to know that the Hegelian dialectic is not about synthesising concept A and concept B (Giegerich et al., 2005). Nor is it about the summing up of discrete concepts available here and there. Rather, it is a form of reasoning that operates through contradictions that are embedded in our living as a means for transformation (Malabou, 2005). For me, we experience contradictions occurring every moment in our professional and personal lives. For instance, I claim to understand that I am concerned about the use of *power* being played out in mathematics education. However, I am not concerned about me using *power* to appropriate entitlements and gain benefits. As I get to know the contradictions between my preaching and practicing, then I possibly move to an ontological state where I can preach about the misuse of *power* whilst giving due consideration to the embodiment of my own preaching.

(b) <u>Negative dialectics from Vedic-Buddhist traditions</u>*:* Reading closely the Advaita Vedanta and Madhyamika School of Buddhism provides me with a common thread of dialectical reasoning employed by Vedic-Buddhist wisdom traditions. The commonality of these traditions is to negate apparent reality so as to get close to eternal reality (Brahman and Sunyata). ***(stands and walks around)***

Advaita Vedanta being a special form of Vedanta *Darshana*, one of the six philosophies (*Darshanas*) based on Vedic traditions, was primarily compiled, developed and disseminated by Shankara, a seventh century philosopher who lived in present day India. This philosophy promotes the view of Advaita (not-two, non-dual) as a means for attaining Brahman, the Absolute (Aleaz, 1997; Balaban & Erev, 1995). Although the Advaitic idea can be found in Rig-Veda and many Upanishads predating Shankara, it was not very clearly teased out ever before Shankara within Vedic traditions[30]. It appears to me that the Advaita tradition uses different forms of logic (analytical, poetic and metaphorical), including a form of negative dialectic, which were explored further by Shankara's successors. The negative dialectic used by Shankara and his followers appeared to use the popular Sanskrit dictum neti-neti (not this not that, neither nor) as a means for generating wisdom about an indeterminate (or primordial) transcendence, a dimension that does not hold worldly (mayic) logics and reasoning (Jones, 1986; Panda, 1991). For me, this aspect of negative dialectic used in Advaita Vedanta has three main characteristics.

Primarily, the idea of neti-neti appears to promote an ontology of non-dualism (Advaita: not-two), for there is no separation between subject and object, self and other, and many other such dualisms. I envisage the space of neti-neti to be a state prior to the occurrence of unhelpful dualisms. Furthermore, the idea of neti-neti helps us realise inherent contradictions that are held by the impermanent/conventional world of languages with restricted reasoning, symbolism and habits of mind. The implication of neti-neti is to give rise to a *(third)space* (perhaps, a primordial space) that helps explore ineffability embedded in sometimes opposing labels, constructs and phenomena (Karunakaran, 1980; Tiwari, 1977). The second characteristic of negative dialectics used by Shankara and his followers is the use of negation as a

[30] In Buddhism, non-dualism has been believed to exist since the time (circa 500 BC) of Siddhartha Gautama, who used silence as an appropriate mode of responding to 'either or' type of questions asked by Sanjay, better known as the sharp questioner of that time (Raju, 1954).

means for demonstrating how different forms of dualisms become a source of avidya (ignorance as a result of egotism) which does not allow one to understand her/his own holistic nature of being. This characteristic of negative dialectic can help expand one's own identity from being restricted by some discrete life roles. The third characteristic of Advaitic negative dialectics is its use as a means rather than an end in itself. This is to say that arriving at the nondual domain of thinking does not require negation because negation of One (an holistic space) does not give rise to the other. This characteristic of negative dialectic prompts me to develop a vision of such a space that allows me to think inclusively and creatively.

Although there are a number of Madhyamika seers, I am using the idea of negative dialectic which appeared in the Chatuskoti (tetralemma) of Nagarjuna, a third century Buddhist philosopher. The Buddhist school of Madhyamika is believed to be a dialectical position between nihilism and eternalism prevailing in Eastern wisdom traditions (Fausset, 1976). It appears to me that Nagarjuna's Chatuskoti is a unique improvisation of the longstanding method of *inquiry as questioning* propounded by Sanjaya and other seers predating Siddhartha Gautama (Raju, 1954). The idea of Chatuskoti entails the art of using the fourfold logic so as to explore the dependent self-nature of objects. For example, the tetralemma for the statement, *I am a teacher*, leads toward Emptiness:

> *I am a teacher (A)*
> *I am not a teacher (~A)*
> *I am a teacher and I am not a teacher (A and ~A)*
> *I am neither teacher nor not a teacher (Neither A nor ~A)*

The main purpose of the negative dialectic of Nagarjuna is to justify the notion that the self-nature of everything is bound to be empty[31]. He seems to perform this by using the principle of dependent co-arising, meaning that a concept or attribute arises by negating its co-related concepts. Perhaps, the idea of dependent co-arising is

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[31] Here the notion 'empty' can be understood as an attribute that signifies not containing anything on its own right and permanently. The quality of containing something (such as its own inherent nature, special properties) is co-dependent upon attributes related to the notion of containing *itself*, although *itself* is also bound to be empty.

closely related to the notion of relativism that every concept and idea is relative to each other. Nagarjuna's perspective helps me hold the view that there is no inherent self-nature of anything including mathematics, mathematics teacher and mathematics teacher educator. Beside this, Nagarjuna's negative dialectic appears to promote a two-truth theory (for those who rest in the state of dependent co-arising) in which the first is the relative/dependent truth in which causation is the imputation of sensory perceptions whereas the second truth, according to Nagarjuna, is 'taken non-causally and beyond all dependence, declared to be nirvana' (p. 214, cited in Loy, 1997). I envisage the term, Nirvana, to be used as a metaphor of inclusion[32]. In essence, Nagarjuna's negative dialectic helps me recognise the co-dependence of the labels representing the nature of mathematics, which besides having their linguistic labels, always suffer from the crisis of inclusive representation of their co-related concept. Furthermore, Nagarjuna's negative dialectics also helps me identify a space whereby all imputed causations (and categories) about assigning a particular label to the nature of mathematics are questioned as a means for developing a multidimensional nature of mathematics and thus an inclusive and contextualised mathematics education in Nepal. ***(sits. stands. walks around and sits)***

(c) Adorno's negative dialectic: While Hegel promoted a positive form of dialectic (as evident in his philosophy of right (Hegel & Knox, 1967)) by starting with a crude entity or concept or phenomenon and later making it refined through Aufhebene, Theodore Adorno (1973) channelized this approach toward a different direction. He appears to be guided by the notion that the longstanding philosophical idea of identification was failing because it was capturing the positive aspect of society whilst ignoring its negative aspects, such as 'Auschwitz'. Characteristically, Adorno applied an immanent critique (or ruthless critique), that is, to critique any entity or concept from its own vantage point. It is this process that appears to critique the gap between the object and its corresponding concept. Adorno also appears to critique the notion of unity between thought and being, terming it a rendition of positive

[32] In a theological sense, Nirvana means no categories. And, categories in one way or other are the key source of exclusion because categories often give rise to partiality, reductionism and exclusivity.

identification. Needless to say, Adorno critiqued the orientation of logics that impose positive concepts upon objects, thus ignoring their inherent differences and diversities (Wong, 2006). I envisage Adorno's negative dialectic to be useful for adopting a critical reflexive posture toward the hegemonic nature of anything, including mathematics. ***(stands)***

(d) Integral dialectics: It appears to me that integral dialectics is found everywhere from Rig-Veda to Sri Aurobindo and Karl Jung to Ken Wilber. Although integral dialecticians also appear to use Hegelian and other forms of dialectics, they seem to have developed it further by allowing dynamic synthesis of seemingly different entities. Whereas Hegelian dialecticians tend to interpret Hegel as starting with a crude 'one' and ending with an enhanced 'one' through *Aufhebene*, integral thinkers seem to advance this approach through using a vision logic which appears to be a meaningful synthesis of two or more interdependent views, phenomena and concepts. Be it the Rig Vedic idea of dynamic amalgamation of diversities for a cosmological holism (de Nicolas, 2003), be it Sri Aurobindo's idea of synthesising evolution and involution (Sri Aurobindo & McDermott, 2005), be it the AQAL[33] model of Ken Wilber (2000a), integral dialectics has played a central role in generating a synergistic and inclusive view of the world. In what follows, I explore some of the characteristics of integral dialects.

(sits. stands) Primarily, integral dialectics is guided by the ontology of holism in which multiplicity of around us are connected together so as to make sense of reality as a whole (Misra, 1998; Wilber, 1998). Furthermore, it also espouses the holonic framework in which the same entity or construct can be both whole and part depending upon the context. The idea of holonic framework gives rise to the third characteristic of integral dialectics, that is, the notion of holarchy (as opposed to hierarchy) in which the lower levels are transcended and enveloped by higher levels. The third characteristic of the integral dialectics is dynamic relationships between constituents (e.g., simultaneity), meaning that constituents interact in different

[33] All Quadrant All Level

directions as a means for making sense of reality. For instance, interactions between 'I' and 'we' make sense of culture and *vice versa*.

My fourth characteristic of integral dialectics is to embrace postformal thinking which is about transcending the formal (e.g., logocentric, Piagetian, rigidly structured, technical rationality-oriented) thinking by using a host of referents including complexity, imagination, construct-awareness, problem-finding, reflexivity, dimensionality of systems thinking, contextualisation, ecological spirituality and envisioning (Hampson, 2007). Perhaps, it can be this dialectic that helps realise the very nature of reality as a complex whole, as opposed to a simplistic logical deduction. The idea of complexity gives rise to the notion of creativity that often demands post-procedural and post-rule-centric thinking. Perhaps, you ***(raises the right hand)*** agree with me that the act of imagination goes beyond rule-following. For me, the notion of construct-awareness is to be aware of the limitations of my own constructs. By being aware of the boundary conditions of any concepts or ideas, I will be able to find problems, at times being aware of my own and others' subjectivities. As I realise the limitation of my own (and others') subjectivities, I am able also to think systemically, which involves dimensionalities and levels, thereby facilitate the generation of contextualised perspectives. One of the important dimensions of postformal thinking is to embrace a post-ontological reasoning in which conceptual mapping or mental modelling may be necessary but insufficient to capture the complexity surrounding us. The idea of ecological spirituality characterises postformal thinking as a means for recognising the notion of sudden emergence/awakening. Unlike in formal logic, where every occurrence should be accounted for and represented by a form of transparent causation, ecological spirituality transcends this linearity by using the analogy of 'coming out of nowhere' to represent the emergence of ideas and constructs. Needless to say, the embodiment of compassion, mindfulness, connectedness and humility helps me develop *eco*logically rather than merely 'logically'. Similarly the notion of envisioning brings forth *vision logic* that unites multiple imaginative techniques and logics (Wilber, 2000b). Here, some of the imaginative techniques can be enlisted as scientific, sociological, cultural, embodied and spiritual, whereas the logics that facilitate visioning can be divided into two categories: conventional logics (single-valued logics: propositional, analytical and deductive) and post-conventional logics (multi-valued logics: metaphors, dialectics, poetics). For me, conventional logics help describe a situation as face value whereas post-conventional logics are a basis for layered interpretation and transformative visions.

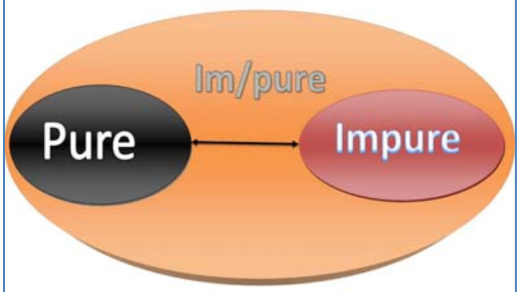
(sits) In this way, these different forms of dialectics will be helpful in conceiving an inclusive nature of mathematics. Although I am not intending to reduce such a complexity enshrined in different forms of dialectical thinking embedded in different cultural and civilisational traditions, I would like to highlight these key features of dialectical logic to be incorporated in conceiving the nature of *mathematics as an im/pure knowledge system*: (i) that the logic of *and* (such as, A and ~A) is more inclusive than the logic of *either or* (A or ~A), (ii) that sometimes opposing concepts co-arise dependently, such as night gives rise to day, *and vice versa*, (iii) that one way of altering dualisms to be a transformative potential is to promote synergy and meaningful blending of sometimes opposing poles of a dualism, and (iv) that a primordial (natural, unconditioned) space can offer ways in which to conceive an inclusive vision of the nature of mathematics.

I have discussed this collective notion of dialectical logic in Section Four and Section Five of the thesis. In Section Four, I have explored key features of dialectical (and other *new* logics) with a view to envision an inclusive and creative vision of mathematics pedagogy. In Section Five, I have used dialectical logic (along with metaphorical and poetic logic) as a referent for developing an inclusive and transformative curriculum vision. ***(curtain falls. sound effect: Narsinga (a Nepali musical instrument like a horn) is played to mark the end of the Act. the Director makes an announcement that the next Act begins in 4/5 minutes)***

CURTAIN RISES

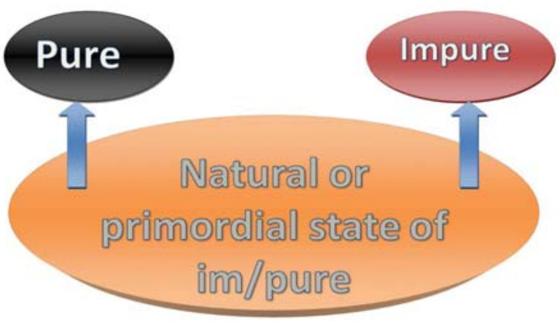
Act 3: Transforming 'Pure versus Impure Mathematics' to Im/Pure Mathematics

NARRATOR: ***(stands. greets with Namaste)*** Having considered different forms of dialectical logic as a referent, I reiterate that the sometimes antagonistic labels of pure and impure knowledge cannot alone serve as an inclusive portrayal of the entirety of mathematics because the label of pure is not inclusive of the label of impure and vice versa. Whilst employing the Hegelian dialectic, I realise that the label of pure knowledge meets with a contradiction because it is not able to capture the nature (or type) of mathematical knowledge that comes under the label of impure mathematics. Can the negation of pure knowledge be free from such a contradiction?



Inclusive Space of Im/pure (I)

Although the label, impure mathematics, is more inclusive than the label of pure knowledge, it still harbours the key contradiction of not being able to incorporate the nature of *mathematics as a body of pure knowledge*. Therefore, I would like to propose the term, ‘im/pure’, which is inclusive of both pure and impure mathematics, that is, still inclusive of its possible antitheses, and which can incorporate various dimensions of the nature of mathematics generated through the synergy of pure and impure mathematics. As mentioned in the poster ***(points to the poster, Inclusive Space of Im/Pure I)***, I envisage the label, im/pure knowledge, to be bigger, more inclusive and more encompassing than the other two labels. Unlike restrictive views embedded in the label of pure (or impure) mathematics, I envisage that im/pure mathematics can be a referent for aligning myself with ‘public educators’ who are guided by social democratic ideals for preparing students as inclusive thinkers, critical citizens and change agents (Ernest, 1991).



Inclusive Space of Im/pure (II)

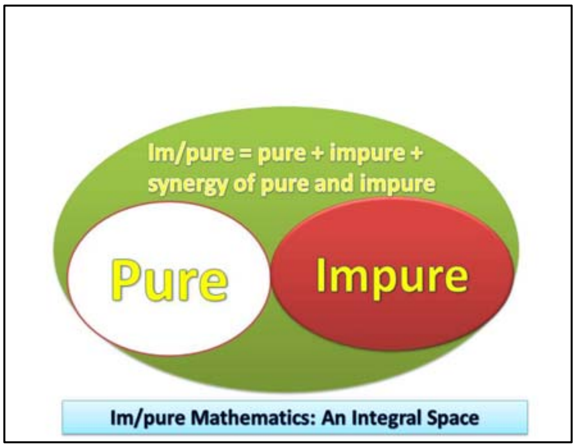
In this process of altering the dualism of pure versus impure mathematics to an empowering label, I would like to use the negative dialectic arising from Advaita Vedanta. The famous Sanskrit dictum, *neti-neti* (not this, not that or neither this nor that) can be used as a referent for identifying the space inclusive of the two static labels that represents sometimes contrary images of the nature of mathematics. Indeed, I have used the neti-neti concept in constructing the titles of Episode I and Episode II of this section. I envisage that the label of im/pure knowledge can be regarded as such an ideal 'primordial' (or natural) space in which antagonism does not exist. Here, the notion of primordial is taken to represent a natural space of non-duality which helps realise how dualistic thinking arises from our 'binary' and unnatural (i.e., conditioned) mindset ***(points to the poster, Inclusive Space of Im/pure II)***. Such a space, at least metaphorically, is useful for me to persuade Nepali teachers and teacher educators that the labels of pure and impure are our interpretive impositions. Although Shankara talks of Advaita (meaning not two) in the context of spiritual experience, it can also be helpful to realise how exclusive dualisms (in Sanskrit it is called Dvaita) are a stumbling block for transforming school mathematics education and mathematics teacher education as an inclusive activity. In a nutshell, the label of im/pure can be helpful for holding the view that mathematics is neither absolutely pure nor exclusively impure knowledge; it is more than these two restrictive labels. Cannot the natural state of im/pure be helpful for ending the 'apartheid worldview' prevailing in mathematics education as experienced by Skovsmose (2005) in his professional travel to Africa?

Arriving at this stage, I am trying to conceive the label, 'im/pure knowledge', from the perspective of Nagarjuna. In particular, Nagarjuna's idea of dependent co-arising ***(points to the poster, Co-dependent Arising: Some Visuals)*** is very useful for understanding that the nature of mathematics depicted through either the 'pure' or 'impure' qualifier is not inclusive because each label simply includes what it is and excludes what it is not at 'face value' (adapted from Ramanan, 1975). However, at a deeper conceptual level, the linguistic labels of pure and impure mathematics co-arise dependently, meaning that we make sense of pure in terms of impure and vice versa, just like making sense of day and night. You may argue here that the term, pure mathematics, can be self-explanatory through labels other than the label of impure, such as algorithmic, abstract, disembodied and culture free. So why do I need the opposing attribute of impure mathematics to fully conceive its notion?

Co-dependent Arising: Some Visuals

Indeed, the conceptions of algorithmic, abstract, disembodied and culture-free also co-arise dependently. For instance, in the moment when I try to conceive the notion of algorithmic, I immediately start making conceptual connection with what is *not* algorithmic. If we look closely at the history of ideas, every philosophy and concept makes its space by articulating what it is not in relation to pre-existing ideas (DeBoer, 1991), thereby cultivating series of swinging dualisms, such as constructivism versus behaviourism, material versus spirit, Western versus Eastern, and mind versus body. Therefore, representing the nature of mathematics through the duality of pure versus impure does not help us construct a much needed inclusive image of the nature of mathematics that can be a referent for conceiving an inclusive curriculum vision for mathematics education. In this context, I envisage the label of im/pure mathematics to be more inclusive of its dependent co-arising than that either of the label of pure or impure.

By using the idea of non-identification and immanent critique (Adorno, 1973; Wong, 2006), I come to understand that the characteristics of 'pure' and 'impure' mathematics do not account for the non-identity of each label, meaning that the label of pure mathematics does not seem to account for the label of impure mathematics, and vice versa. Thus, the notion of non-identification has, primarily, helped me critique the hegemony of the nature of *mathematics as a body of pure knowledge* in which the purity of mathematics has been taken to be natural by many Nepali teachers and teacher educators. Furthermore, I have used Adorno's critical dialectic to minimise the gap between the signifier concept (such as, pure or impure) and the signified object (mathematics) as a basis for exploring an holistic and multidimensional nature of mathematics. While using Adorno's immanent critique, I am able to explore the hegemonic nature of mathematics embedded in either of the images of the nature of *mathematics as a body of pure knowledge* and *as impure knowledge*. In my view, the immanent critique of the nature of *mathematics as an im/pure knowledge system* is likely to incorporate its non-identification into identification.



In the process of articulating my vision of transforming the widespread dualism of pure versus impure mathematics to an inclusive label of im/pure mathematics, I am using yet another referent, integral dialectics, for conceiving the forward looking nature of *mathematics as an im/pure knowledge system*. In my mind, integral dialectics can be used to promote synergistic blending of sometimes opposing views, labels and ideas for creating such an inclusive vision of the nature of mathematics. Furthermore, integral dialectics helps envision a dynamic relationship between parts that come together to form a whole. Perhaps the term 'synergy' can best describe the synthesis by which both pure and impure mathematics interact, thereby generating images of mathematics different from, and inclusive of both pure and impure mathematics. This poster ***(points to the poster, Im/pure Mathematics: An Integral Space)*** can be helpful for us to visualise the space of im/pure mathematics with the help of integral dialectics. Unlike some 'capital p' philosophers of mathematics (e.g., Logicists: Russell, Frege, Formalist: Hilbert, Intuitionist: Brouwer (Hersh, 1997, 2006; Lerman, 1990)) who have conceived their worldview by excluding every other perspective and creating unhelpful dualistic labels and ideas, integral dialectics is useful for me to conceive a 'small p' philosophy that helps realise the notion that sometimes antagonistic views (such as, pure and impure), events and phenomena are an inseparable reality of our lifeworlds, similar to what Gergen (1995) mentions to be a blending of lived and life, subject and object, meaning and meant. ***(curtain falls. the Narrator seen moving around the stage)***

CURTAIN RISES

Act 3: Im/Pure Knowledge System and its Possible Implications

NARRATOR: ***(stands. sits. stands and walks around)*** Arriving at this performative stop, I would like to elaborate how I conceive the transformation of mathematics as a *body of pure knowledge* to an im/pure *knowledge system*, thereby briefly articulating how it can be useful for conceiving mathematics education as an inclusive enterprise.

As there can be different perspectives for articulating the notion of knowledge system, I choose the integral dialectics for conceiving its inclusive and empowering notion. In my mind, an integral view of knowledge system offers a much needed dynamic, interactive and inclusive view of mathematical knowledge (Floyd, 2008; Kupers, 2008), thereby accounting for changing and unchanging, emergent and pre-existing, contextual and de-contextual, algorithmic and textual, and embodied and disembodied aspects of mathematical knowledge. What is likely to be the status of the metaphor of body of knowledge within an integralism-inspired knowledge system? I envisage that such a knowledge system is inclusive of the metaphor of *mathematics as a body of knowledge* as well as *mathematics as human activity* because both aspects of the nature of mathematics continue to exist side-by-side, thereby giving rise to reflexive, interactive and iterative relationships between different dimensions (e.g., pure and impure; body of knowledge and human activity; embodied and disembodied) of the nature of mathematics. Perhaps, these relationships embodied in an inclusive knowledge system of mathematics can be depicted by what Ernest calls a dialogical (and dialectical) nature of mathematics (Ernest, 1994a). I have envisaged that the following key pointers of differences between a body of knowledge and a knowledge system somehow help articulate the multidimensional image of the nature of *mathematics as an im/pure knowledge system* ***(refers to the poster Multidimensional Nature Of Mathematics hung on the wall)*** as an orienting referent for school mathematics education and mathematics teacher education in Nepal.

Multidimensional Nature Of Mathematics

- The idea of 'body of pure knowledge' appears to be promoting a unidimensional view of knowing that mathematical knowledge is contained in a textbook, teachers' minds and in the syllabus of the curriculum. In contrast, I envisage the notion of an im/pure knowledge system to represent a dynamic interaction between different aspects of the system, such as representational (emerging and normative ways of expressing mathematical knowledge), epistemic (holistic and reductionist ways of knowing) and logical (formal and post-formal[34] ways of conceiving mathematical knowledge).

- The metaphor of body of pure knowledge is likely to promote mathematics as a finished product, thereby giving the impression that mathematics is always as such. On the contrary, I have come to realise that the label of an im/pure knowledge system includes both pure and impure and other forms of mathematics created through their synergy, thereby giving a fair emphasis on both front (pure, finished product) and back (impure, ongoing activity) aspects of mathematics.
- An exclusive emphasis on the image of 'body of pure knowledge' promotes a host of conduit/container metaphor, thereby locking mathematics pedagogy in the world of transmissionism. In my mind, the conduit metaphors promote the disempowering view that signs and symbols unproblematically transmit meanings from teachers to students. I envisage the image of 'im/pure knowledge system' to promote inclusive metaphors of co-construction, linking, sharing, two-way street as referents for empowering pedagogies.

In this way, I have presented what I have learnt, felt and realised about the disempowering unidimensional and empowering multidimensional nature of mathematics. My purpose of envisioning an inclusive nature of *mathematics as a body of im/pure knowledge system* is to use it to conceive an inclusive, agentic and multidimensional vision of mathematics education with a view to rescuing mathematics education from the trap of elitism, unidimensionality, decontextualisation and hegemony. Considering it as a heuristic tool (as opposed to full and final) for enhancing pedagogical wisdoms, I envisage the multidimensional nature of *mathematics as an im/pure knowledge system* to provide students and

[34] Post-formalism is an attempt to blur unhelpful boundaries created by dualisms. Post-formalism can be realised fully by employing inclusive logics such as dialectical, metaphorical, poetic and narrative.

teachers with much needed access to multiple forms, views and approaches to mathematics. After experiencing ‘multiple’ and ‘singular’ forms of mathematics, students and teachers are likely to conceive a comprehensive picture of mathematical knowledge and skills that is useful for their present and future lives. ***(curtain falls. the Director makes an announcement that the performance is over for today. an inspirational music that says unity in diversity is played. people in the audience disperse)***

Recapitulating the Present, Mapping the Futures

Using five compositely constructed stories as a basis for my epistemic journey, Section One has been developed on the basis of my experiences as a student, lecturer, researcher and teacher educator, thereby aiming to explore possible answers to these research questions: i) *Which image(s) of the nature of mathematics have been governing the existing mathematics education in Nepal?*, and (ii) *How can they be re-conceptualised as a basis for developing an inclusive vision for mathematics education in Nepal?* In writing this section, I have used the conceptual referent of dialectical logic and the epistemic technique of performative imagination so as to investigate the widespread hegemonic nature of *mathematics as a body of pure knowledge*. Whilst identifying the limitation of this nature of mathematics, I have discussed the ideology of singularity, the epistemology of objectivism, the language of universality and the logic of certainty as its key features in the first Episode/Chapter of this section. More so, I have expanded my storied experiences as a student, teacher and teacher educator to articulate how ideology, epistemology, language and logic promote an exclusive and elitist view of school mathematics education and mathematics teacher education in Nepal.

My second Episode (i.e., Chapter 2), which begins with two stories of my experiences as a researcher and as a teacher educator (depicting the influence of the nature of *mathematics as impure knowledge*), has challenged the uni-dimensional nature of *mathematics as a body of pure knowledge*, thereby generating yet another powerful antithetical image of *mathematics as impure knowledge.* Although the notion of impure knowledge is more culturally inclusive than the nature of *mathematics as a body of pure knowledge*, it still holds some contradictions as it is not inclusive of pure mathematics. After exploring some weaknesses inherent in this antithetical nature of mathematics, I have envisaged its potential feature of culture as a static entity to be disempowering and hegemonic. Rather than allowing students to cross different cultural borders, the idea of using self-culture as the sole basis for pedagogical enactment may promote an apartheid view of education. Furthermore, inherent in the narrowly conceived linguistic label of impure mathematics are a host of unhelpful dualisms which by no means help promote an inclusive mathematics education in Nepal. These shortcomings have prompted me to explore potential conceptual tools, that is, different forms of dialectics (Hegelian dialectic, Negative dialectics from Vedic and Buddhist wisdom traditions, Adorno's negative dialectic and integral dialectics) to conceive an inclusive and multidimensional nature of *mathematics as an im/pure knowledge system* which constitutes both pure mathematics, impure mathematics and mathematics arising from the synergy of pure and impure mathematics.

In the process of developing the multidimensional nature of *mathematics as an im/pure knowledge system*, I have encountered a number of research issues needing further exploration, such as dualism, reductionism and inclusive curriculum vision, to name a few. Section Two of the Thesis explores key features of prevailing dualism in the field of mathematics education. Situating myself in the year 2004 when I was involved in launching a one-year mathematics teacher education program, the section also includes my articulation of a thirdspace pedagogy as a way of addressing the exclusionary posture created by many unhelpful dualisms. Similarly, Section Three addresses the problem of different forms of reductionism that create the grounds for an exclusive mathematics education. Referring to the different forms of dialectics discussed in this section, Section Four identifies four *new* logics as a means for conceiving inclusive mathematics pedagogy that has been un/wittingly assaulted by the *old* logics of proposition, deduction and narrow analytic. By using the multidimensional nature of mathematics as one of the referents, Section Five reports the process and outcomes of my inquiry into the formulation of a synergistic image of *curriculum as montage*, a basis for developing an inclusive curriculum vision. Last but not least, Section Six of the thesis refers to the multi-dimensional nature of mathematics for harnessing empowering aspects of globalisation and challenging the narrow view of foundationalism, thereby developing a vision for an inclusive mathematics teacher education.

SECTION TWO: DISSOLVING DUALISMS: SEARCHING FOR INCLUSIVE ALTERNATIVES

Orientation

In Section Zero of this thesis, I articulated how I encountered unhelpful dualisms in my life as a student, mathematics teacher and teacher educator, thereby giving rise to them as a theme of my inquiry. In Section One, whilst exploring key features of the nature of *mathematics as impure knowledge*, I felt that dualism is one of the stumbling blocks for conceiving an inclusive mathematics education because of its tendency to divide phenomena, concepts or events into two mutually exclusive opposite categories and to privilege one of them. In my experience, such a disempowering feature of dualism is embedded in exclusively didactic and teacher-centred pedagogies of mathematics. Given this background, the following three research questions guide my inquiry into key unhelpful dualisms in mathematics education that I have experienced as a mathematics teacher and teacher educator in Nepal: (i) *In what ways does dualism restrict mathematics education from developing agentic and inclusive pedagogical visions?, (ii) What unhelpful dualisms may be governing mathematics education in Nepal?, and (iii) How can those unhelpful dualisms be addressed for envisioning inclusive pedagogical visions?*

With these research questions at my disposal and narrative imagination as the key epistemic technique (Section Zero), I have formulated four key purposes in this section. First, I aim to investigate meanings and types of dualisms, giving due emphasis to my lived experience as a teacher educator. Second, I intend to explore ways in which dualism prevents mathematics pedagogy from being an enterprise inclusive of human activities. More so, the third purpose of my inquiry in this section is to explore inclusive pedagogy as a basis for reconciling unhelpful dualisms with a view to envisioning an inclusive mathematics education. In this process, I also aim to demonstrate how an epistemic technique of narrative imagination can be used for examining my own professional practice as a transformative teacher educator.

Section Two

Guided by Rorty's view that human thinking becomes a source of progress not by becoming more rigorously certain but by becoming more imaginatively open (Bagni, 2008), I employ aspects of narrative imagination (see Section Zero) as an epistemic technique in this section. One of the hallmarks of the narrative imagination is to use 'facts' (experiences) for the purpose of cultivating present and futures (or fictive) possibilities. Here, the term 'fictive' is used to portray an epistemic emphasis on imaginative thinking which is otherwise hidden in exclusively fact-based research.

The section comprises three chapters: Chapters Four, Five and Six. Chapter Four grows out of the composite story, *Capturing A Moment With Mr. Stiff*, constructed on the basis of my conversations with a number of principals of private schools in Kathmandu Valley. The story is followed by a reflective-narrative exploration of meanings of dualisms together with examples of key unhelpful dualisms that I have encountered as a teacher educator.

Starting with a semi-fictive vignette, *Enter Mr Stiff's Sacred Diary Page,* Chapter Five uses a lineland metaphor (borrowed from the novel, *Flatland* (Stewart, 2001)) so as to portray students' and teachers' lifeworlds under dualism. Here, I hope to use the Deweyian idea of *education* <u>*as*</u> *life* (without rejecting the view of *education* <u>*for*</u> *future life*) as one of the orienting perspectives of my exploration.

Finally, Chapter Six incorporates the thirdspace and dissolution metaphors as a basis for generating an inclusive pedagogical space. With the signature story, *Stuff Them Insofar As You Can*, the chapter also uses aspects of dialectics (see Section One) arising from Advaita Vedanta and Madhyamika as a means for articulating an inclusive pedagogy of mathematics education.

Section Two

CHAPTER 4: PRELUDE TO DUALISM: MEANINGS, SOURCES AND IMPACTS

Capturing a Moment with Mr. Stiff

"I am not in favour of sponsoring my teachers to participate in these teacher training programs because they do not teach appropriate mathematics to teachers," speaks Mr. Stiff, taking a sip of tea. "How can you make a mathematics teacher competent without teaching adequate pure mathematics content? I think these teacher training programs are responsible for weakening the quality of education because of their over emphasis on so-called pedagogy."

It can be any day in July 2004. I am sitting in the principal's office of East-to-West Secondary School in Kathmandu. I sense now that Mr. Stiff's arrow-like words are making me agitated. I pause for a while to console my ego and choose some non-confrontational words and sentences to keep our conversation going. I remind myself that I need to convince him to send his teachers to our teacher education program.

"Well, you are right to say that mathematics teachers need to be well versed in subject matter. Beside this, we also pay equal importance to pedagogical approaches that are required to become a competent mathematics teacher," I speak passionately and look at his deputy who shakes his head in favour of every conversant, not knowing whether he shakes his head in favour of or against the ideas. "For me, a good teacher education program makes a teacher open to new ideas, ready to explore his/her weaknesses and strengths, and devise contextual strategies to support many, if not all, students. We also aspire to be a good teacher education faculty for our country."

Mr. Stiff's body language tells me that he does not seem to buy my ideas. I withdraw purposely because I want him to engage with my ideas. Will he really engage in my ideas or it is just my wishful thinking?

"Sir, your ideas are good for university professors. I have to live in a real world where parents expect their children to secure good marks in mathematics. A teacher

with good mathematical knowledge is the only solution for this because s/he can devise appropriate strategies to make students learn important mathematics for their exams, such as the SLC", pauses Mr. Stiff, at times gazing through the window next to his table. "In the end, we need quality education which can ensure high achievement in 'hard' subjects, such as mathematics and science. I know that you will try to convince me how good student-centred teaching techniques will be. But I always believe in the contrary: it is the teacher-centred approach that ensures certainty in and control over students' learning and their performance. Indeed, the teacher-centred approach, which demarcates the task of teaching and learning very clearly, is our cultural heritage."

Although the room accommodates a fair amount of cool air, competing ideas seem to create heat in my corporeal body, perhaps showing some degree of displeasure on my face. I manage to tighten my lips in order to prevent from expressing rather antagonistic views. Now, I am not sure about the usefulness of this type of dialogue that is marching along a fractured pathway. Perhaps, I need to say 'farewell' to this hard rock telling him the consequences of living in an exclusive and archaic worldview.

Prologue

A sentence says more than
what it aims to convey
A word is more than
what it appears to be
An alphabet is more than
what it carries
A sound is more than
what it entails

If it was merely a sound,
no punctuation would be needed
If it was merely an alphabet,
cases would be meaningless
If it was merely a word
dictionary would not be popular
If it was merely a sentence
clarifications would be redundant

After entering this new space of writing, a wild question comes to mind: Has the story, *Capturing A Moment With Mr. Stiff*, finished? Finishing a story seems to indicate the shifting of responsibility from the writer to readers who, then, interpret the story from their own vantage points. Literally, one can say that the story, has been finished because the genre has changed, the voice has switched, and the plot has discontinued. On the contrary, a metaphorical take on this matter gives a different account that the story can lead further than we read literally in the plot, than we experience in the storyline, and than we see in the simulacra of characters. Thus, it does not feel quite convincing that I should adjourn the responsibility of telling because there is much to tell and share about issues that are embedded in my storyline. What happens if I buy into literalism, a realist approach to understanding meanings of terms, concepts and ideas? Perhaps I will not be able to embrace the interconnected nature of text and textuality, rather I will be promoting yet another dualism that the story has come to an end and its interpretation is planning to emerge as a separate text. On the contrary, embracing a metaphorical lens gives me the view that such a separation does not account for the interdependence and intertextuality[35] (Gergen, 1995) that exists between different genres which help progress my story of knowing, being and valuing.

How can I, then, continue telling the story so that my readers can make sense of the problem of dualism faced by mathematics education in Nepal? My telling intends to unite multiple voices, thereby canvassing an ever-developing story of my experience of being with others. The term 'other' does not have a single meaning here; rather it indicates an array of meaning-imageries. As other it can be referred to decontextualised mathematics (or pure: symbolic, abstract, algorithmic) that has been embedded in the mathematics curriculum of Nepal. Such an 'other' has the propensity to be separated from and to be superior to 'self', that is, local (or impure: artefactual, informal, communal) mathematics arising from the cultural practices of Nepali people. Where does this dualism of self versus other come from? What do I mean by dualism? Which may be the dominant dualisms that prevent mathematics education from being inclusive?

Constructing Meanings of Dualism

In the history of Western philosophy, the concept of dualism appears in the writing of Plato who separates *ideal* (Form) from *mundane* (form) as a basis for claiming to know the sacred, pure and uncontaminated knowledge. Descartes continued this legacy by introducing a far-reaching dualism of body versus mind. Rather than going through a philosophical classification and clarification of dualism, I try to construct its meanings on the basis of my vantage points by employing different tools, such as

[35] Relationships between texts

literalism, metaphor and poetic logic (see Section Four). Literally speaking, dualism is the tendency to classify concepts, statements and events according to duals, as belonging to only one of two all-encompassing, mutually-exclusive categories with essentially fixed meanings (Núñez et al., 1999). Perhaps, this definition tells us the idea that *A* and *not-A* cannot be considered together under a dualistic worldview, thereby promoting one particular category as the signifier of the entire conceptuality. With the help of metaphors and images, I find *dualism as exclusion*, *fracturing* and *linearity* (Davis, 2005). These images may help reflect upon the extent to which mathematics education in Nepal prepares students to see the world as a container of binary opposites from which they must select the unchangeably right answers. When using poetic logic, a logic that speaks for ineffability, I make sense of dualism as:

a day without night
a life without plight
imposed categories replacing life
imprisoning living by restrictions
ideas restraining openness and creativity
despising present moments
hounding openness
excluding complements

A dualistic approach to categorisation and representation of concepts seems to have a number of implications for mathematics education in Nepal. Primarily, dualism promotes the notion of domination of one category over the other, thereby harbouring reductionism in its core. Looking at the Enlightenment Project reveals an array of dualisms that have been promoting the regime of domination via a narrowly conceptualised view of science and mathematics education, thereby replacing (reductively) relational by rational, lived experience by categories, empathy by logic, and text and textuality by number(Fleener, 2005). The reductionist domination of relational by rational thinking seems to have prevented Nepali mathematics education from incorporating local knowledge systems in mathematics curricula. This situation is likely to promote a reductionist view that mathematics education is all about the domination of fact, formula, proposition and algorithm over lived experiences. Section Three of the thesis explores the notion of reductionism, its types and its unhelpful influences in conceiving holistic pedagogy in mathematics education in Nepal.

The dualistic regime of domination seems to justify subordination, if not elimination, via rationalistic-deductive reasoning, a strong form of which promotes a 'yes versus no' logic which has been (dis)orienting mathematics education in Nepal to disassociate from its diverse social and cultural capitals. Where does Nepali mathematics education receive such a dualistic indoctrination from? Given the nature of this question, I have used two major sources to search for answers. The first source comes from the voice of people who work in the field of education (e.g., Davis, 2005; Doll & Gough, 2002; Taylor & Wallace, 2007). For them, the foremost basis for dualism in the field of mathematics and science education is the Western Modern Worldview, a view of the world promoted by scientism that espouses naïve realism [36] as its ontology and positivism[37] as its epistemology. Although naïve realism and positivism help uncover some aspects of truth, they tend to mask the complexity of knowing (and knowledge) via a number of dualisms enshrined in Cartesian philosophy and Newtonian science. The pre-modern Western view that the world is lawfully ordered and thus it can be flawlessly depicted via binary opposites seems to have been absorbed by Newtonian science and Cartesian philosophy, and thus by the Western Modern Worldview, which successfully renewed the longstanding dualism propelled by Plato's Form (ideal) versus form (mundane). In this genealogical trail of the Western Modern Worldview there appears a time when Europe reaches out to justify its political and cultural

He arrived in our place
with benevolent eyes
with some sacks of coins
as if he would serve us
as if he would help us

Gradually, he brought his friends
Started eyeing our places
He became an ally first
And turned out to be a boss
Then he began to dictate
We all nervously watched

He said we don't know how
So he began us to show
We watched nervously again
Not knowing what we would gain

His show hasn't ended yet
We are still waiting to speak
But don't know when
we get back our turn?

[36] The view of reality as correspondence between external objects and mental maps which is accompanied by knowledge as a tangible object.

[37] One of the dominant research paradigms (at least philosophically) that promotes the view of evidence to exist out there. In educational research, postpositivism shares many tenets of positivism.

hegemony over the rest of the world. Among many hegemonic practices, imposing Western Modern Worldview-guided curricula and education models upon their colonies has disoriented mathematics and science education in many Asian and African countries (Taylor, 2006; Vithal, 2004). Impliedly, mathematics education in Nepal has been prone to dualism due to the Western Modern Worldview being considered as its guiding perspective resulting from the cultural, political and social confluence of different forms of colonialism. Can I say that the importation of British-Indian colonial images of *curriculum as subject matter* (i.e., content), *mathematics as a pure body of knowledge* and *teaching as transmission* are a source of unhelpful dualisms? Can I say that the narrow view of *globalisation as the blind importation of the Western Modern Worldview* has infiltrated mathematics education by means of many unhelpful dualisms? In Section Five, I shall discuss how the exclusivity of such an image of mathematics curriculum (as subject matter) contributes to an elitist and decontextualised mathematics education. In Section Six, I shall explore the notion of globalisation in relation to my experience of being involved in formulating a mathematics teacher education program for the University of Himalaya.

> Two years ago, Kamala raised a question
> Sir, Why should we study algebraic factorisation?
> The teacher plays the same old tape
> It is useful for your future life
>
> Last year, Kamala raised a similar question
> Sir, where can I use the geometric proof in my life?
> The teacher opened his old notebook
> and read loudly:
> It won't help you now
> but will certainly help you in the future
>
> This year Kamala raises yet another question
> How can I use coordinate geometry in my life?
> The teacher replays his infamous answer
> I don't know that but it surely helps in your future life
>
> After six years, Kamala will raise the same old question
> Professor, what is the usefulness of mathematics in my present life?
> The professor opens his lecture notes and writes on the tattered chalkboard
> I don't know about its use in your present life
> But it is surely useful for your future life
> ---
> Ms Kamala, why should I study mathematics?
> A talkative student asks bluntly
> Because it is useful for your future life!
> Ms Kamala re-produces the same answer
> that has grown up with her!

The second source of my answers is my cultural situatedness, on the basis of which I make certain knowledge claims. Although the major source of dualism in mathematics education is the Western Modern Worldview, I also need to acknowledge that some aspects of Nepali cultural practices are also responsible for promoting dualism in mathematics education. Despite having rich wisdom traditions that cultivate holistic, relational and ecological thinking, the longstanding social hierarchy based on caste, gender and ethnicity has also contributed to unhelpful dualisms, such as superior versus inferior, male versus female, adult versus young, and manager versus managed (Pradhan, Shrestha, & Mission, 2005). Paradoxically, many worthy practices enshrined in our wisdom traditions appear to have submerged in unhelpful practices that are prone to hierarchical dualistic thinking. Viewed from a critical cultural perspective, dualism appears to be a distortion of our cultural wisdoms as a result of narrowly ritualised reading of our traditions. Moreover, the tendency of promoting literal ritualism might have restricted many empowering interpretations of wisdoms from occurring and being practised. Given such a context of distortion, Mr. Stiff might have read our culture through a literal orientation to claim that an exclusive teacher-centred approach is our cultural construct. Perhaps, he would have benefited from reading Brihadaranyaka Upanishad, a Vedic philosophical text, that advocates for an undifferentiated and holistic vision of the world as opposed to the exclusively differentiated and partial description propelled by dualism (Muller, 1955). For me, an exclusive form of differentiated seeing indicates exclusion, setting apart, creating boundaries and discrimination whilst the undifferentiated vision opens up an avenue for dissolving differentiations, discriminations and unhelpful borders. Perhaps, this perspective would help Mr. Stiff to dissolve disempowering demarcations between teacher-centred and student-centred education, teaching and learning, and teacher and student, thereby embracing an inclusive vision of education?

Identifying Unhelpful Dualisms

As I continue to tell the story, *Capturing a Moment with Mr. Stiff*, a question tries to colonise my thinking. What are the unhelpful dualisms for mathematics education in Nepal? Subscribing to Krishnamurti's (2005) view of the-answer-is-in-the-question-rather-than-outside-of-it, I make sense that not all dualisms are unhelpful. Indicatively, my intention is not to dismiss all dualisms; rather my purpose is to explore ways in which to address unhelpful dualisms that are less than supportive for promoting inclusive mathematics education in Nepal. For me, the idea of the un/helpfulness of dualism is decided by the extent to which it endorses exclusivity, elitism and one-dimensionality in mathematics education. Based on my reading of the story, I consider three major dualisms – content versus pedagogy, pure versus impure mathematics, and teaching versus learning – as the key unhelpful dualisms restricting mathematics education in Nepal from being an inclusive enterprise. Nevertheless, this does not mean that these are the only unhelpful dualisms that the story talks about; instead it is my perspective that shapes un/wittingly my text in this discursive frame.

a) The content versus pedagogy dualism appears to have been guided by the foundationalist legacy that content (subject matter) is deemed to be superior to pedagogy, a methodological realm of knowing and communicating. For me, Foundationalism refers to the idea that the mathematical knowledge system is based on some unchangeable basic beliefs expressed via axioms (and postulates) (Hersh, 1997)[38]. It is this perspective that does not recognise the role of creative pedagogical space for enacting mathematical knowledge. Furthermore, the foundationalist view of mathematics regards pedagogy as a negligible constituent that always precedes content. Thus, the separation and inferiorization of pedagogy from content takes many unhelpful turns and twists in mathematics education (see Section Six of this thesis, where I have discussed foundationalism in the context of formulating a mathematics teacher education program). From a feminist perspective, the empathic dimension of mathematics education is possibly stripped away because of the lack of creative articulation of pedagogical realms (Berry, 2007). In such a situation, it is likely that mathematics education remains aloof from exploring and embodying multiple pedagogical approaches that could rescue mathematics education from the legacy of one-size-fits-all. From a mathematics-as-activity perspective, this dualism supports exclusion and elitism by promoting one particular type of mathematics that does not consider creative and contextualised enactment of mathematics (content) so

[38] Hersh uses foundationism rather than foundationalism. Perhaps, he does so to distinguish it from the postmodern generic uses of foundationalism as a basis for critique without realising specific nature of foundations in each discipline.

as to make it suitable according to the needs of learners from diverse cultural and language groups, rather it seems to promote an archaic view that mathematics is not for all, but is only for bright students. If so then why should it be included in the school curriculum?

b) The dualism of pure mathematics versus impure mathematics is inextricably linked with the content versus pedagogy dualism in which the idea of content (subject matter of mathematics) is believed to be pure, that is, symbolic, formal, abstract and algorithmic. Moreover, the dualism of pure versus impure mathematics emanates from the one dimensional view of the nature of *mathematics as a body of pure knowledge* (see Section One), thereby labelling the impure forms of mathematics (informal, local, artefactual, communal, verbal) as inferior to the pure form. This dualism, therefore, has a tendency of dismissing the use of local knowledge systems in the school mathematics curriculum and pedagogy. What might be the negative effects of this dualism? For me, one of the potential effects is to harbour an elitist agenda for promoting one particular type of mathematics as if there are no other forms of mathematics available to us. The dualism of pure versus impure mathematics also echoes the same exclusive agenda of mathematics-is-not-for-all as promoted by the dualism of content versus pedagogy. In a nutshell, the tendency of endorsing mathematics as an exclusively symbolic, formal, and abstract knowledge system does not help develop the cultural capital of learners through mathematics education (D'Ambrosio, 2006).

When will they enter in maths class?
The petals of marigold
The banquet of rhododendron
The collection of pippal (fig) tree leafs
The fractal of Bodhi tree
When will they enter in maths class?

When will they enter in maths class?
The map of my village settlements
The matrix of my mother's work schedule
The method of my father's problem solving
The pattern of land distribution in my village
When will they enter in maths class?

When will they enter in maths class?
The algebra of my family genealogy
The geometry of wicker baskets
The arithmetic of local harvests
The statistics of my village budget
When will they enter in maths class?

c) As I begin to enact meanings of the dualism of teaching versus learning, Mr. Stiff renews his voice that teaching and learning cannot go together, that the mixing of them makes the task of teachers and educators difficult, and that the demarcation between teaching and learning should be unshakable. Perhaps, the meaning enshrined in this dualism has been well articulated by Mr. Stiff's renewed voice which seems to dispel an ecological view that teaching and learning are inseparable, concomitant and unbreakable (Sloan, 2005). Arising from this dualism is the far-reaching image of *mathematics education as unconnected charting of the* course, meaning that the act of teaching is equated with an act of finishing the course without accounting for the journey of students. Perhaps, mathematics education in Nepal has sourced this dualism from three different traditions. For me, the behaviourist notion of *teaching as animal training* has contributed to generating the view of teaching as instructing and learning as mastering the instruction through blind faith and practice (Hilgard & Bower, 1977). Such a view has been bolstered further by the cognitive notion of *teaching as imposing knowledge structure* and *learning as sequential addition of knowledge* to the internal mental network of the learner (Shuell, 1986). Here the notion of knowledge structure does not seem to be different from the list of content embedded in the image of *curriculum as subject matter* (Schubert, 1986). And, the cognitive view of teaching and learning does not seem to resolve these questions: What is the source of knowledge structure that is being imposed upon school mathematics curriculum? Whose interests are being served by the knowledge structure? Perhaps, the third source of the dualism of teaching versus learning is the literal interpretation of our cultural traditions that teaching and learning entail mutually exclusive tasks enacted by the guru and disciples. However, such a reading does not seem to account for the blurred relationship of gurus and disciples as a transforming consciousness that accounts for a connected, inclusive and expanded self.

> I am a teacher?
> Because I make decisions
> as if I am a commander of their lives
> Because I say I am one of the learned persons
> as if I have known all mysteries
> Because I am older than them
> as if I know all intricacies of living
> Because I am the one who speaks most
> as if I represent their feelings and thoughts
> I am a teacher?
>
> I am a teacher?
> Because I can ask, 'Do you understand?'
> as if I know what understanding is all about
> Because I talk about past and future
> as if I know how it looks like to be there
> Because I say mathematics is universal
> as if I really know what the universe entails
> I am a teacher?

Arriving at this stage of my journey, I have generated some conceptual, reflective and critical meanings of dualism that prevents mathematics education in Nepal from being an inclusive enterprise. I am planning to look at the way in which the lives of teacher educators, teachers and students are restrained by the dualisms of content versus method, pure mathematics versus impure mathematics, and teaching versus learning. Keeping this goal in mind, I continue my journey of investigating potential consequences of having dualism as the 'life referent' for students, mathematics teachers and teacher educators.

CHAPTER 5: IMAGINING LIVES UNDER DUALISM: A 'LINELAND' METAPHOR

Enter Mr. Stiff's Sacred Diary Page!

I am very happy today about my performance in front of a professor who was persuading me to send my teachers to a useless 'education program'. As a mathematics graduate, I asserted my firm belief that mathematics teachers should not indulge in some airy-fairy stuff but instead appreciate the nature of mathematical certainty that helps us understand the world through a simple, yet powerful binary logic. Of course, I am very proud of this mathematical worldview because it has helped me keep my school on track, as a result of which it has been producing better results in the SLC exam. If I allowed murky ideas, such as student-centred teaching, problem-based learning, teaching for thinking and mathematics education for all to enter my school, it would not be able to make the level of 'profit' that it has been making now. Needless to say, the binary logic embedded in my thinking has provided me with a very powerful shield to protect my school from maverick ideas about mathematics and education.

Nevertheless, I admit I have been living in fear during the last three years. The source of my fear is the ongoing publicity of these maverick ideas through local and global media outlets. These days, I hear my teachers talking about useless issues in the staff room. Last week some of my teachers were talking about democracy in the mathematics classroom. The other day, they were talking about an oxymoronic idea, ethnomathematics. Last month, one so-called child-rights activist came to my office to convince me about a child-friendly environment in the school. He was also complaining about the way in which mathematics has been taught in schools. But can we mix politics, culture and ethnicity in mathematics?

Prologue

Reading Mr. Stiff's diary may help you understand his worldview which does not seem to differ from what the *humble square*, a character of a Victorian-time novel, Flatland (Abbott & Stewart, 2002), finds in the king of 'lineland' who doesn't really know how to operate within the *flatland* because of its two-dimensionality, which is drastically different from the uni-dimensionality of lineland. The term 'lineland' can be a metaphor for the prevailing one-dimensionality that is embraced by a dualistic worldview. As the image of lineland comes to my mind, I visualize humans (and other creatures) being reduced to dots and lines. Metaphorically, the idea of converting multidimensional humans (and other creatures) into lines resembles the way in which a dualistic worldview has a propensity to divide any concepts, ideas, events and phenomena related to our lives into all-encompassing binary opposites, thereby privileging one of them as the ultimate signifier. This does not mean that I totally reject the presence of binary opposites in mathematics education; rather I critique the way in which such binary opposites are considered as the only way in which to generate meanings and perspectives.

> He says I should not be here
> Because I do not have the brainpower
> He says I should not raise any question
> Because that hinders his mission
> He says I cannot look outside
> Because there is no actual math site
> He says I cannot talk to my pal
> Because it blocks the *maths channel*
>
> A man in his fifties
> With long moustache
> Tells me that I am useless
> Because I cannot make
> symbols fit in his jigsaws

Beside the lineland metaphor, I am making use of another powerful concept, *education <u>as</u> life*. Thanks to Dewey for such an important idea which enables me to see a range of possibilities that go beyond the dualistic notion of *education <u>for</u> [future]life*, which has an interest in setting apart education from day-to-day life experiences and lived realities (Semetsky, 2008). Alternatively, the notion of *education <u>as</u> life* puts an emphasis on integrating everyday life experiences into education, thereby empowering the agentive dimension of *learners as citizens*. Embracing the Deweyian notion of life-education relationships, my upcoming journey aims to look at the lives of teacher educators, teachers and students under the dualisms of content <u>versus</u> pedagogy, pure <u>versus</u> impure mathematics, and teaching <u>versus</u> learning.

The Not-Known Recipient

I return to the lineland world (view) in order to investigate how different dualisms of mathematics education in Nepal impact the life of the student as a learner. Initially, I take notice of the widespread content versus pedagogy dualism which unwittingly makes student believe that mathematics education does not value anything but the subject matter which rarely speaks to their day-to-day realities. The process by which they learn mathematics is not considered important because of the restrictive notion of *doing mathematics as following the dictation of the teacher*. In this situation learning turns out to be an act of passive reception as if there are no active roles for students to play other than to re-produce carbon copies of routine algorithmic problems. Mr. Stiff's depiction of subject matter versus pedagogy as a vertical dualism, in which one of the two binary opposites is believed to be superior to the other, does not seem to help students cultivate their agency as learners and citizens because the subject matter is always depicted as superior to human life. In such a situation, students continue to find themselves at the receiving end, thereby being disempowered to think and act creatively.

Encountering another widespread dualism, pure versus impure mathematics (see Section One), presents me with a number of images of students being forced to think mathematics as an alien knowledge system with many restrictions and essentialisms imposed upon them. As this vertical dualism[39] of pure versus impure mathematics is played out in the school curriculum, students seem to find it hard to believe in the idea that mathematics comes from their lifeworlds. Reflecting upon my own experience as a student of primary and secondary levels of education, I remember our teachers' prescriptions -- *this is very important for your future* -- in response to our struggle to make sense of many theorems and definitions. While this category (pure versus impure) underlies mathematics education the notion of curriculum is incorrectly conceptualised as the business of a handful of experts. Students, then, find themselves being located at the receiving end rather in the realm of participation and ownership.

Can students also teach mathematics teachers? This question comes to mind as I begin to imagine the lives of students under the teaching versus learning dualism. The strict form of this dualism puts students in a world where they are generally

[39] Dualism that forms a hierarchy of superior versus inferior.

denied their say because they are meant to receive ideas from teachers. The notion of learning, according to this dualism, seems to be translated as following blindly others' ideas. Again returning to the lineland metaphor, I see students being programmed to understand the world from a prescriptive perspective, thereby limiting their vision of enacting transformative roles in their present/future lives as citizens. Nevertheless, this is not to say that we should get rid of these roles from our school education; rather we need to cultivate possible recourses to the unjustifiable dualisms that severely limit the creative and agentive possibility of mathematics education.

A Peripheral Authority

How will I act as a teacher if I am guided by prevailing dualisms in mathematics education, such as content <u>versus</u> pedagogy, pure mathematics <u>versus</u> impure mathematics, and teaching <u>versus</u> learning? In taking on board the content <u>versus</u> pedagogy dualism, I find myself living a life of pretence. Although I pretend that mathematics is all about getting right answers, I find myself frustrated at having very limited possibilities offered by the dominant image of *curriculum as subject matter*. I am also frustrated because I cannot assess my students on the basis of their struggle in making sense of mathematics, rather I am compelled to judge their mathematics exclusively on the basis of right answers. I love to have a variety of activities to help my students but the dominant image of curriculum as subject matter makes me run through a line(land) of subject matter without giving due emphasis to student participation.

The dualism of pure <u>versus</u> impure mathematics puts me in a series of dilemmas. Although I see mathematics being practised differently in the lives of people, due to the unilateral emphasis upon the image of *mathematics as a body of pure knowledge* in the school mathematics curriculum of Nepal I am compelled to share with my students a very limited view of mathematics. Although I know that impure mathematics can be really helpful for students to understand mathematics *in situ*, I am prepared to propagate the unjustifiable view that pure (symbolic, formal and decontextualised) mathematics is the only nature of mathematics. I have to act like a cleric who always speaks the language of *dos and don'ts*. I am bound to impose the persona of a mathematics teacher as an authority of pure mathematics in my soul that would otherwise develop a vision of *mathematics as a human activity* (Restivo & Bauchspies, 2006). Indeed, the lineland worldview embedded in pure versus impure dualism uses my teacherly space to dismantle the equally powerful view of mathematics as an impure knowledge system.

Coming to know that the Vedic Sage, Datattreya, who despite being hailed as a great teacher acknowledged as his prime gurus different animals and persons believed to be living in a state of ignorance, a state of gloominess occurs in my mind due to the prevailing vertical dualism of teaching versus learning. Under this dualism, my role as a teacher is so confined that it is hard for me to enter the classroom as a different person and personality. Although I have learnt so much precious knowledge from students, there is no space for this to be shared with them. All I need to do is pretend that I know all about mathematics and they need to respect me as a police-guru. Indeed, this dualism promotes a win-lose pedagogy as a way of enacting the mathematics curriculum, meaning that if I get mathematics right they must get it wrong. Therefore, this dualism does not help me to conceptualise a 'third space' (Gutiérrez, Baquedano-Lopez, & Tejeda, 1999) (see Chapter 6) wherein I and my students can share something mutually, respect each other, swap our roles occasionally, and make mathematics education a humanlike enterprise. I have to admit that this dualism does not seem to encourage me to embody and practice an holistic teacherly state (guru-ness), rather it makes me live a life of pretence that I am a teacher forever.

> The moment I am free to share
> The day I am released to wander
> The week I am allowed to speak
> The month I am open to my heart
> The year I embark on searching
> The decade I hear you telling
>
> I will be no more a teacher
> who pretends to be a knower
> of all secrecies of what I teach
> of all mysteries of what I behold
> of my life which I don't know a clue
> yet
>
> Then who will I be?
> Perhaps a person who just tries to 'be'?

A Reproducer of Status-Quo

My life as a teacher educator under the dualism of content versus pedagogy does not help me develop an holistic vision of mathematics education. If I favour content over pedagogy, I may turn away from the creative aspect of knowing and communicating about mathematics. In such a situation, I will continue to advocate for reproducing foundationlism through the image of *curriculum as subject matter* that hardly takes account of empowering images of *curriculum as currere* and *cultural reconstruction* (Pinar, 2004). The notion of currere as autobiographical excavation of learners may challenge the one-size-fits-all hegemony of content. Likewise, I may stay away from the image of *curriculum as cultural reconstruction* because of its critical posture that can be used to deconstruct the hegemonic culture promoted by foundationlism. What will happen if I prefer pedagogy over content? Perhaps, I will be imagining a 'form' without much-needed 'substance', thereby preventing my visions from being creative, holistic and transformative.

In order to imagine my life as a teacher educator guided by the dualism of pure versus impure mathematics, I take a brief tour of Shankara's *Vivekachudamani*, a Vedic text (Ramaswamy, 2003). In verse 302 Shankara talks about being free from purity (Sattva) in order to culminate the higher Being. Shankara seems to indicate here that the claim of being 'pure' is likely to generate the idea of 'impure', a label that normally signifies something inferior or lesser. Living under such a dualism of pure <u>versus</u> impure mathematics, I seem to enforce the view that any form of impure mathematics (informal, artefactual, verbal, communal) does not help maintain the high standards of mathematics, thus pure mathematics <u>should</u> be advocated right from the first day of schooling. In this situation, I will become a prisoner of my one-dimensional thinking about mathematics education that mathematics had nothing to do with qualitative, cultural, social, political and spiritual aspects (being, feeling, sharing, voicing and creating) of my and my students' lives. In effect, my standpoint gets very close to that of comprador intelligentsia who, playing the role as local agents of the Western Modern Worldview, do not see any educational value in local, mundane or informal mathematical knowledge systems (Fanon, 1986; Section Six). Although I advocated strictly an academic and elitist mathematics (i.e., pure mathematics), I find myself in the dilemma of seeing many students suffering from this narrowly conceived nature of mathematics. Thus, I may begin to suspect the usefulness of pure mathematics for improving the literacy of Nepali students. So I change my existing standpoint and advocate the total replacement of pure mathematics by impure mathematics. Some years later, I may encounter another sort of problem that Nepali students cannot do well in conventional mathematics. I might then turn back on my previous standpoint, that pure mathematics is superior to impure mathematics.

How do I live my life as a teacher educator within the dualism of teaching versus learning? Perhaps, I find myself embracing 'teaching' over 'learning' because of my ego as a mathematics teacher. Perhaps I always resist the urge for learning by raising this question: Why do I need to learn because I am a teacher? Ironically, my teaching persona becomes stagnant after some years as I finish emptying the container of knowledge. Or, I develop a reified version of my 'teaching knowledge' as a result of what Mezirow (2005) calls 'epistemic, sociocultural and psychic distortions' which prevent me from developing integrative and holistic perspectives. Here the notion of distortions indicates the potential deformation of knowing, acting and being resulting from a dualistic worldview. Furthermore, these distortions do not help me go beyond the conditioned labels, ideas and thoughts. Then, after some years I start complaining that I need to *bank* some more knowledge via a formal study program. Indeed, I begin to search for knowledge outside my professional praxis. During this entire episode I continue to teach my student-teachers that they need to believe me, whilst I suspect my own conviction that I am really teaching something useful.

Activity makes sense of passivity
Passivity gives rise to activity
Where is passivity without activity?
How can I see activity without passivity?

A day constitutes dawn and dark
The dark can be a source of spark
Where is purity
that does not arise from impurity?
Where is impurity
that doesn't show us purity?

Is reality all about binary opposites?
Or just our linguistic constructions
Or there is something 'else'
where we dump all our imaginations

Having investigated the lives of students, mathematics teachers and teacher educators under the dualisms of content versus pedagogy, pure versus impure mathematics, and teaching versus learning, I am now setting out on another brief journey that tries to unpack some visions for addressing the problem of dualism in mathematics education in Nepal. For this, I have introduced two unique conceptual constructs – the third space metaphor and the dissolution metaphor – hoping to challenge the notion of solving as reforming.

CHAPTER 6: RESOLVING AND DISSOLVING DUALISMS: THINKING IN-BETWEEN AND BEYOND

Stuff Them Insofar As You Can!

It can be any Friday in August 2004. Mr Stiff starts the day with his routine work of checking the status of yesterday's fees collection. He is very particular about the fees because this year many people are urging private schools to not charge excessive and unjustified fees. 'If the situation turns ugly…?', whispers Mr. Stiff to himself, remembering recent calls for transparency in private schools in terms of their financial, administrative and educational functioning. He quickly bids farewell to these unhelpful fillers and starts planning today's staff meeting. A wild idea comes to his mind that today he is going to talk to maths teachers only. He smiles for some unknown reason, as he commands an attendant to circulate his divine-like notice of 'Maths Teachers Only Meeting' around the school.

All five teachers enter the principal's office at 2 pm, being unaware of Mr. Stiff's specific agenda for the meeting. Generally, they do not ask for their agendas to be included nor do they request a wider sharing of Mr. Stiff's agenda beforehand. Perhaps, they are well aware of Mr. Stiff's perspective that teachers should not be consulted but instructed by the school management. He often cites alien theories of management that the productivity of teachers depends exclusively on the control factor, meaning that the more you control your teachers the better productivity you will get.

"Well, you need to focus on the upcoming SLC (School Leaving Certificate; similar to Matriculation) exam in which our students need to secure good marks. Perhaps, you all are aware of the fact that your performance is measured by the marks obtained by each student in the SLC exam", chimes Mr. Stiff taking sips of some unknown liquid. "For those who are teaching in grade 7 and onwards: make sure that you have prepared at least six sets of test-papers and make students practise them thoroughly, if possible every day."

The room becomes quiet as if there is not a single living creature. In the meantime, one of the teachers, who has been teaching the middle grades (grade 6, 7 and 8) tries to say something as Mr. Stiff keeps on turning the pages of his diary.

"Sir, I am sorry to share otherwise but I think our purpose of teaching mathematics is not only to make students ready for tests and exams but also to focus on developing conceptual understanding and other skills required for their life", speaks the teacher passionately, taking off his cap. "I found an interesting article about different types of teaching strategies that may help inculcate deep thinking of mathematical concepts. I am also very excited to implement some of the project-based activities suggested by the author of that article"

"I do not believe in these ideas. These are all fads and do no good for us, at least not for my school. What I believe in is preparing students for securing good marks in exams. Your ideas do not match at all with the school mathematics curriculum prescribed by the Curriculum Development Centre (CDC), which lays emphasis on making students able to know formulas, solve algorithmic problems, prove theorems and memorise mathematical facts. Students automatically know mathematical concepts after they become well versed in basics. I cannot allow you to invite any trace of uncertainty in our mathematics class by allowing these un-mathematical and half-true ideas."

Mr. Stiff believes firmly that the teacher who has been trying to put forward his uncanny ideas has now been smashed completely. And, this is also a great lesson for other teachers who may have some impure, fuzzy and half-true ideas. The rebellious teacher shuts his mouth knowing that this is not the place for the cultivation of his creativity. Finally, Mr. Stiff reads out some five/six dot points as the summary of today's meeting. One of them appears to be: 'Stuff them insofar as you can'.

Prologue

A day with a good dream
like swimming in a clean stream
like flying in a clear sky
like climbing a big tree
like becoming totally free
from sorrows and pains
like marching toward mountains
like meeting someone who inspires
like watching doves making a nest

A day with a good dream
possibly helps keep going
possibly gives some clues
possibly offers some directions
possibly opens some new perspectives

A day with a good dream
possibly helps me see the unseen.

How can I read the story, *Stuff Them Insofar As You Can*? Although there are many ways of reading and making sense of the story, I am using an approach to imaginative-dialogic reading (Bakhtin, 1981) to generate a vision for a transformative and inclusive mathematics education that helps Nepali students and teachers cultivate their personal, social and cultural agency as active citizens. Constructing such a vision for transformation and inclusion helps address the problem of exclusion and elitism faced by mathematics education due to many unhelpful dualisms as discussed in the previous sections of this chapter. I have considered two major conceptual lenses – the 'third space' metaphor and the dissolution metaphor – so as to facilitate the process (and product) of envisioning, thereby enabling me to visualise a potentially empowering and meaningful mathematics education for the lives of students, teachers and teacher educators. Nevertheless, rather than claiming that my vision is 'the' only available vision, I intend to regard this as one out of many possibilities.

The Thirdspace Metaphor

The third space of enunciation, popularly known as hybrid space (Bhabha, 1994), appears to be an empowering critical cultural construct for addressing dualisms arising mainly from the Western Modern Worldview that is embedded in school mathematics curricula of Nepal. Conceptually, the third space metaphor represents a series of dialectical movements between and beyond binary opposites (see Section One), thereby opening a new vista for thinking and actions (Dunlop, 1999). The idea of dialectical movement (see the concept of dialectics in Section One and Four of this thesis) represents a continuous conceptual shifting aiming to generate holistic meaning (Hood, 2006). The notion of *third space as dialectical movements* suspends the prevailing essentialisms that content and pedagogy cannot be mixed, that the roles of teaching and learning are always separated, and that pure mathematics is always superior to impure mathematics. The categories representing binary opposites in mathematics education require a renewed articulation so as to represent ever unrecognised fluidity, liminalities, uncertainty and partiality embedded in them. In this process, a new space for relationships is essential for translating dualism into inclusive-holism as a recourse to the prevailing elitism in mathematics education in Nepal. Another important hallmark of such a thirdspace pedagogy is to cultivate creative tools of thinking arising from poetic, metaphorical, dialectical and narrative logics. Section Four of the thesis explores such logics as an alternative to the *old* logics of proposition, deduction and narrow analytics.

Thus, the idea of third space is about thinking and acting inclusively via dialectical thinking for generating synergies from prevailing antagonisms. Rather than selecting a partial category to represent the entire conceptuality, dialectical thinking helps me hold together antagonisms, binary opposites and dichotomies so as to develop an ecological, inclusive and interdependent perspective (Wong, 2006). What will happen to dualistic categories if we embrace a third space perspective? For me, they will remain as partial representing categories rather than all-encompassing categories, thereby engendering much-needed synergies for thinking inclusively and creatively (Soja, 1996). Nevertheless, a third space perspective does not maintain the dualistic status quo; rather it is about inviting creative openness and expanding the territory of envisioning.

The notion of *third space as aspiration* helps me re-envision the lives of teacher educators, teachers and students. How do I envisage my life as a teacher educator who embraces the third space metaphor? Rather than treating dualisms as separate and all-encompassing categories, I look for empowering relationships between them as a means for reconceptualising my currere as a citizen (Gutiérrez et al., 1999). Therefore, holding the third space metaphor helps develop an interdependent mode of thinking and actions rather than exclusively isolated and individualistic thinking arising from Cartesian dualism (Fleener, 2005). How do I, as a teacher educator, use the third space metaphor to address the problem of exclusion and elitism created by the dualisms of content versus pedagogy, pure versus impure mathematics, and teaching versus learning? With the third space metaphor in hand, I regard ‘content’ and ‘pedagogy’ as essential, but insufficient, ingredients, thereby reconceptualising a space for contextual enactments of mathematics education. Where is subject matter that is free from pedagogy (or method or methodology or epistemology) and vice versa? Holding this perspective helps me to look for ways in which to make mathematics education a more creative and inclusive enterprise.

By addressing this dualism of teaching versus learning, I will be able to look at different aspects of my identity being reconceptualised via the third space metaphor. Rather than limiting myself by the discourse of teaching and learning tasks, I choose to talk about identity because it is what underlies my thinking, actions and becoming (Rao, 2002; P. Watson, 2005). Perhaps, considering myself as a reflective practitioner enables me to shift from the fixed ‘body-role identity’ as a teacher educator to a learner and *beyond* (McHugh, 2004; Palmer, 2003; Sankaracharya, 1970). Therefore, rather than sticking exclusively on to the idea of I-am-a-teacher-educator, the third space metaphor helps me explore the following four possibilities for my ever-expanding identity (Nagarjuna et al., 1990):

(a) I am a teacher educator
(b) I am not a teacher educator
(c) I am a teacher educator and not a teacher educator
(d) I am neither a teacher educator nor not a teacher educator

If I hold (a), I will be trapped by the linguistic label of teacher educator as if it is my fixed identity. Although this identity helps remind me of my roles and responsibilities in my workplace, I cannot be a teacher educator forever as I have other roles to play in my life. Thus embracing (b) indicates that I need to be inclusive of other roles that I have to play in my life, thereby shunning an unhelpful ego that tries to represent my identity as superior to some others, including my students. If I embrace (c), then it allows me to act as a teacher and learner depending upon the situation. But it may not help me to see outside of these roles and responsibilities. Therefore, (d) helps me to go beyond the language labels being projected onto my identity. Needless to say, it is the third space metaphor that enables me to operate within and beyond the notion of unity within diversity, in-between, synthesis, and both/and.

Embracing the third space metaphor, I, as a teacher, will be able to develop a renewed sense of being in a place where cultural and linguistic diversity is the lived reality of my students. While addressing the duality of content versus pedagogy, I will stay away from the idea that mathematics education is all about transmitting the subject matter of mathematics, thereby employing inclusive and empowering methods to generate mathematics from our shared spaces. The third space constitutes many spaces in which all of us (I and students) use our lived realities in order to generate mathematics *in situ*. Likewise, the third space image of mathematics as an im/pure knowledge system serves as a referent for developing teaching modules and activities that include a range of pure and impure *mathematics*. In this process, I will be able to involve my students in community-based inquiries and problem solving that facilitate them to understand how different people use mathematical knowledge in their daily practices. Perhaps, this is one of the several methods for translating the notion of *education as life* in reality.

The dualism of teach(ing)/(er) versus learn(ing)/(er) is transformed into the third space of 'being', which I have used earlier to envision my life as a teacher educator. Here, I choose the term 'being' because of the duality embedded in becoming. The notion of being helps expand my temporal and 'superimposed' identity as a teacher, which represents some fixed roles and responsibilities rather than an ever-expanding self that looks beyond language labels and signifiers that often prevent me from thinking and acting holistically (Fausset, 1976; Malkani, 1961). The third space metaphor, therefore, provides me with ground for being an holistic person (a teacher, learner, activist, thinker, carer, participant), who also teaches mathematics whist constantly examining the purpose and value of his teaching, learning and enacting of mathematics.

How will the lives of students be conceptualised after subscribing to the third space metaphor? The dualism of content versus pedagogy will be transformed into an empowering notion of *mathematics education as activity* in which students' active participation is essential. Rather than becoming passive recipients of content, students take part actively in the process of generating mathematics from their contexts. In this process, another dualism of pure versus impure mathematics is morphed into a multidimensional im/pure mathematics, thereby providing students with opportunities to gain firsthand experience of constructing mathematics from their lived reality. Needless to say, the image of mathematics as an im/pure knowledge system also provides a basis for students to cross multiple borders between local, national and global cultures (Gutiérrez et al., 1999), thereby embracing the multiple roles of knowledge constructor, communicator, questioner, thinker and young mathematicians. In so doing, they will set themselves in the third space of being by expanding their previous identity of the knowledge receiver.

The Dissolution Metaphor

I have used three major sources for constructing the idea of the dissolution metaphor as a conceptual tool for envisioning an inclusive and transformative mathematics education. Primarily, I have drawn the notion of dissolution from the Vedic tradition, according to which dissolution becomes inevitable for the Cosmic Creator when the existing framework turns out to be incapable of solving worldly problems (Panikkar, 1977). Metaphorically, this view of dissolution has an interest in conceiving a totally new reality similar to that which I have set out to envision an inclusive mathematics education, which is (hopefully) devoid of many unhelpful dualisms. Next, I borrow the concept of dissolution from within the scientific disciplinary perspective in which the notion of dissolution has a set of meanings ranging from finding a solution to seeing the *unseen* (Karukstis & Van Hecke, 2003). For instance, dissolving sugar cubes into a cup of tea helps find a new solution, a sweetened tea. The sugar (solute) and the tea (solvent) form a new solution giving a taste different from that of exclusively sweet (sugar-generated taste) or sour (original taste of tea). Borrowing the idea of *solving as dissolving*, I can perceive that the multi-lingual and multi-cultural context of Nepal can be the solvent while the dualism of content versus pedagogy, pure versus impure mathematics, and teaching versus learning play the role of solute. Similarly having considered the metaphor of *dissolving as seeing the unseen* reminds me of the popular example of dissolving NaCl into water in which the solution shows an entirely different crystal structure of NaCl in water from that of the NaCl outside of water. For me, the analogy of dissolving NaCl into water gives the notion that dissolving dualisms into Nepali multi-cultural and multi-cultural contexts shows new visions and perspectives which could not be seen by staying within the dualistic framework of the Western Modern Worldview.

The third set of ideas upon which I draw the notion of dissolution arises from recent educational and philosophical perspectives rooted in postmodernism and Integralism (Slattery, 1995; Wilber, 1996). My notion of post-modernity is about exploring multiplicity and doubting foundational thinking whereas the meaning of Integralism entails an holistic mosaic of diversity. Taking a postmodern curriculum perspective, Fleener (2002) suggests dissolving old questions of education (performance of students, teacher efficiency, standardization of curriculum) rooted in the dualistic worldview because solving these problems does not help transform education. Here the notion of dissolving old problems does not signify an escape; rather it stands for an opening of new perspectives that might not just offer a short-term solution rather it potentially offers a sustainable resolution. For me, Fleener's idea of dissolution is not different from John Dewey's idea of dissolving the demarcation between life and school so as to generate a meaningful and empowering perspective of education (Granger, 2006). In a similar vein, Rorty (in Niznik & Sanders, 1996) has suggested dissolving the dualisms of subjective versus objective, rational versus irrational, discovery versus making, and fact versus fiction so as to open a new vista of thinking about philosophy. Drawing upon the Integral paradigm, the dissolution metaphor provides me with a basis on which to realise a holistic perspective of everything including education. The paradigm has given me a view that dissolution of fractures and demarcations is essential for instilling sustained dialogues between self and other, I and we, culture and social, and science and spirituality. Of particular interest in this paradigm is the idea of developing a non-dual perspective[40] that expands one's own self from beyond dualistic language labels (Cupane, 2007). In a nutshell, the dissolution metaphor helps me to conceptualise an inclusive mathematics education that shuns many unhelpful dualisms arising from the dualisms of content versus pedagogy, pure versus impure mathematics, and teaching versus learning.

In what ways does the dissolution metaphor help me act justifiably as a teacher educator and mathematics teacher? Dissolving the dualisms of content versus pedagogy and pure versus impure mathematics offers me a new vision of thinking about mathematics education in contextualised terms, that is, the existing cultural, social and lingual diversity of Nepal. Rather than exclusively serving the interests of

[40] Non-duality is a way of interpreting reality that is considered undifferentiated and non-hierarchical. Vedas and Upanishads have described the world as undifferentiated totality that unites with Brahman. Similarly Madhyamika Buddhism introduces the concept of Shunyata so as to depict the concept of interdependence and co-arising.

comprador intelligentsia (i.e., professors, mathematicians and cosmopolitan consultants who think that West or North is the best!), I am more interested in promoting a culturally contextualised mathematics education that speaks directly to the reality of Nepal. Perhaps, in so doing I will be able to contest the narrow view of globalisation as importing mathematics from the so-called First World (Kyle, 1999; Vithal, 2003). Similarly, the dissolution of the dualisms of content versus pedagogy and pure versus impure mathematics facilitates me to shift the focus of the mathematics education of Nepal from *whats* and *hows* to *whos* and *whys.*

As in the third space metaphor, dissolving the dualism of teaching versus learning helps me to think beyond my role identity as a teacher or teacher educator. By using the Zen perspective of turning inside to myself (Pereira, 2006), the dissolution metaphor helps me to constantly examine my teacherly role so as to make it more meaningful, satisfying, inclusive and service oriented (Olson, 2000). In the process of turning to my inner landscapes, I will also become a seeker who eventually makes use of the ideas of self-realisation rather than relying exclusively on the recitation of words. In a similar line, Ramana Maharshi's approach to self-inquiry (Gandhi, 2003) facilitates me to question many taken-for-granted assumptions that often make my role identity fixed and unchangeable. Rather than exclusively using the mind (*buddhi,* intellect, logic) Ramana Maharshi's call for opening one's own heart (*hridaya: the centre of body-mind,* empathy and mindfulness) is useful for me to come out of the limited identity trap which does not help me to act in an open, inclusive and creative manner.

Imagining how the dissolution metaphor helps empower student lives takes me to the space where students are treated as ends-in-themselves rather than as means to other ends (Taylor, 1998). This agentive dimension will be realised fully if students become the centre of attention of mathematics education. Perhaps, dissolving the dualisms of content versus pedagogy and pure mathematics versus impure mathematics provides me with a new reality that helps incorporate the multiple interests, voices and cultures of students in mathematics education. More importantly, the dissolution of these dualisms potentially challenges Nepali educators to think mathematics education in terms of the aspirations of students rather than the imperialism of binary opposites. In what ways will students be empowered if the dualism of teaching versus learning is dissolved? The dissolution metaphor opens ground for students to think and act as active citizens in their present lives rather than as passive recipients of mathematical knowledge that is believed to be useful for their distant future. Why do we always envisage mathematics education in terms of the restraining classroom semiotics that shuns the possibility of expanding the role of students (and teachers)? Why do we not envisage mathematics education as a restriction-free and creative enterprise? How and when can this utopic thinking be translated into reality?

Recapitulating the Present, Mapping the Futures

I commenced Section Two by considering the protracted problem of dualism infecting almost every aspect of mathematics education of Nepal. Taking on board my experience as a teacher educator and the epistemic technique of narrative imagination, I argued that an exclusive emphasis on dualism is not helpful for conceiving much needed inclusive pedagogical perspectives for helping students to access powerful mathematical ideas useful for their present and future lives. In doing so, I discussed 'content versus pedagogy', 'pure versus impure mathematics', and 'teaching versus learning' as unhelpful dualisms that prevent mathematics education from being an enterprise inclusive of human aspirations and activities. After elaborating a number of problematic aspects of dualism, the metaphors of *thirdspace* and *dissolution* evolved as bases for conceiving inclusive pedagogical spaces that can re-solve and dissolve otherwise 'taken as natural' boundaries of unhelpful dualisms.

In Chapter Four (of this section), I raised an issue that dualism can be a source of reductionism that has been influential as an ideology, epistemology and logic of mathematics education in Nepal. As a result of this, in Section Three I will undertake an inquiry into the phenomenon (and noumenon) of reductionism. Furthermore, Section Four of my thesis will guide my journey of inquiry into different forms of *old* logics that promote many unhelpful dualisms in mathematics education in Nepal.

With the help of the thirdspace and dissolution metaphors, I envisioned ways of resolving and dissolving unhelpful dualisms as a basis for conceiving inclusive and agentic pedagogies for mathematics education in Nepal. Such pedagogic visions can be fully translated in the classroom if an inclusive, agentic and transformative curriculum vision governs the process of designing, implementing and assessing the mathematics curriculum. Therefore, Section Five of this thesis explores ways of conceiving a transformative curriculum vision that creates synergies of sometimes opposing attributes prevailing in the field of mathematics education.

In this section, I raised the issue of globalisation being (mis)used as a means for justifying the privilege of the Western Modern Worldview in mathematics education. Furthermore, I have also argued that an exclusive emphasis on foundationalism orients the unhelpful dualism of content versus pedagogy. In Section Six, I explore these issues as a basis for conceiving an inclusive and transformative vision for developing a mathematics teacher education program.

SECTION THREE: SURGERY ON REDUCTIONISM: A JOURNEY FROM 'T/HERE'

Orientation

My autobiography presented in Section Zero of this thesis has demonstrated that reductionism is a recurring theme of my professional lifeworlds as a student, mathematics teacher and teacher educator. Similarly, whilst writing Section One, I quickly realised that reductionism has been the key orienting perspective of Nepali mathematics education, thereby privileging the uni-dimensional image of *mathematics as a body of pure knowledge*, a view of the nature of mathematics that promotes a singular form of mathematics (i.e., pure: symbolic, algorithmic, abstract, formal) whilst discarding other equally important forms of mathematics (i.e., impure: artefactual, embodied, communal, informal). Although I briefly articulated the notion of reductionism as a worldview that prevents mathematics education in Nepal from being an inclusive and holistic endeavour, I felt that I needed to undertake an inquiry into the notion of reductionism with a view to unpacking its contextual meanings and features. Next, writing Section Two made me realise that reductionism could prevent me from transforming from a dualism-inspired educator to a transformative teacher educator (and researcher) who aims to envision an inclusive mathematics education. Therefore, with a commitment to explore, embody and envision an inclusive mathematics education as a meaningful alternative to reductionism, I now embark on the journey of exploring the disempowering nature of reductionism embedded in my situatedness with these initial inquiry questions: *(i) What is reductionism?*, and (ii) *In what ways does reductionism promote culturally exclusive and elitist views of mathematics education?*

My inquiry in this section has been guided by four key aims. First, I intend to explore meanings of reductionism from ideological and epistemological vantage points. Second, I aim to unpack types of reductionism prevalent in the field of mathematics education in Nepal. Third, I seek ways to address the hegemonic impact of reductionism on pedagogic-, and assessment-related practices of mathematics education. My fourth aim is to demonstrate how I can make creative use of performative imagination to investigate epistemic and pedagogic issues arising from my everyday professional experiences.

Subscribing to performative imagination as the orienting epistemic technique (see Section Zero), the section is organised in a hierarchy of episodes, acts and performances. The section can serve as readers' theatre[41] in which they 'perform' texts without any rehearsal. More so, narrative imagination is used to construct stories of my experiences as a teacher educator.

Beginning with the signature story, *Precise Curriculum, Short-Cut Method and Correct Answer,* the first Episode (i.e., Chapter 7: Exploring Meanings of Reductionism from Within and Outside) explores meanings of reductionism via storied, dialogic and narrative genres. In this performative context, an ensemble of *characters* explores disempowering implications of a reductionist worldview for mathematics education in Nepal. In the second episode (i.e., Chapter 8: Delving into Key Types of Reductionism), the signature story, *Finally The Monotonous Class Is Over*, constructed on the basis of my experience of observing a number of mathematics classes, gives a sneak preview of reductionist pedagogy in a Nepali mathematics classroom, thereby opening the curtains for a performative genre to explore different types of reductionism embedded in mathematics education in Nepal. Finally, the following list of characters and their descriptions/attributes can be helpful for readers (and performers) to have a pre-reading (or pre-performing) understanding of their potential roles in generating plurivocal performative texts. The characters of Director, Storyteller, Narrator and Tutor represent aspects of me as a researcher, teacher educator, storywriter and social activist. The character of Pratap represents a composite character constructed on the basis of my experience with in-service teachers whom I taught in the years 2004 and 2005, and Mr Cutback is also a

[41] Readers' theatre is an approach to performing research texts with minimal resources and preparation (Donmoyer & Donmoyer, 2008). In this type of performance contexts research texts are held and read out to the audience and performers need not memorise scripts. Staging can be simple as available props can be use to represent visuals and scenery. This approach to performance promotes a radical form of drama occurring in each moment of our life.

composite character constructed on the basis of my experience of interacting with a number of school principals during those years.

Character	Description	Story, Snapshots, Timeline and Features
Director	A backstage character who manages and facilitates the theatrical performance, represents aspects of inquirer's persona and role	Started the present inquiry in mid-2006, always grapples to create dialogic and coherent texts.
Narrator	An onstage character who performs the key role of the inquirer.	Taught teacher education units in 2004/2005, observed a number of classes of in-service teachers, held a vision of critical mathematics education, initially encountered some passive resistance from some of his students, generates narratives of his life experience as a student, teacher and teacher educator
Storyteller	An onstage character who is interested in mythic, folk and reflective storytelling, represents aspects of inquirer's role.	Has been writing mythical stories about his life as a student, teacher and teacher educator.
Tutor	An onstage character who is interested in transforming the hearts and minds of mathematics teachers, represents aspects of inquirer's role.	Tutored mathematics education units in the University of Himalaya from 2004 to 2006. Shares his experience through reflective stories.
Pratap	An onstage character, playing a high school mathematics teacher who did not initially want change in his conventional (reductionist) view of mathematics education. But, he began to embody critical and inclusive perspectives soon after he realised the usefulness of ethnomathematics in his teaching.	Started teaching in a private school in the middle of 2001, appointed as the head of the mathematics department after three months of his career as a teacher, was loyal to the principal, was defensible about his reductionist view of mathematics education until December 2004 but changed afterwards, undertook an ethnomathematics project as his final assignment that helped him become convinced of the usefulness of ethnomathematics in making mathematics meaningful, left the school in April/May 2005.
Mr. Cutback	The principal of a private school, where Pratap worked as a mathematics teacher in 2004/2005, does not have an onstage role but has been referred to by Pratap.	Founded a private school (pre-primary to grade 10) some 15 years ago, makes a sizeable income out of it, has a ruthless view of education, seems to hold the reductionist view of mathematics as a body of pure knowledge and mathematics teaching as transmission.

EPISODE I (OR CHAPTER 7): EXPLORING MEANINGS OF REDUCTIONISM FROM WITHIN AND OUTSIDE

(the Director makes an announcement that Episode I starts shortly, briefly reminding the audience of the nature of emergent performance in this drama.)

CURTAIN RISES

Act 1: Precise Curriculum, Short-Cut Method and Standard Evaluation

TUTOR: ***(sound effect, soft flute music, is on. the poster, Poetic Whys, is pasted on the flannel board next to his chair. stands)*** *It can be a Saturday in the second half of September, 2004. I am about to attend to presentations by students who have recently started a one-year teacher education program for secondary schoolteachers. The students and I have agreed that each presenter uses a maximum of 30 minutes of time to share their views of teaching and learning mathematics, which they are likely to develop after reading unit learning materials and reflecting upon their own practices as teachers. After watching eight presentations in the last three weeks, I am feeling happy to hear presenters making strong commitments for incorporating an inclusive and meaningful approach to mathematics teaching.*

Poetic Whys

Why am I questioning
the purity of numbers?
Why am I critiquing
the mathematics of Forms?
Why am I challenging
invisible uni-dimensionality?
Why am I resisting
mathematics for homogeneity?

Why am I arguing
for abandoning rote memorisation?
Why am I advocating
for an holistic evaluation?
Why am I disrupting
the Euclidean model of thinking?
Why am I supporting
an inclusive envisioning?

Why am I questioning
authoritarian methods of teaching?
Why am I critiquing
the metaphor of assessment as
labelling?
Why am I challenging
the add-on view of assessment?
Why am I resisting
the view of learner as object?
Contd…

My classroom becomes a politically, culturally, sociologically and epistemologically charged space. "The 'ical ideas sound quite revolutionary. I heard your students uttering terms like power, inclusion and equity in mathematics education," some of my colleagues share their realist impressions. Initially, all students resist my multi-perspectival view: all they want is a math-centric perspective, meaning they try to overprivilege a reductionist view of mathematics education. However, I try to break this interlocking and conforming discourse of their pedagogical practices. Gradually, they begin to comment critically on their colleagues' presentations. Some of them start using new words (although they appear to be misused), such as construction, cooperative, empower, hegemony and participation so as to represent their ideas. I admit that I have been using my teacherly discursive power to shape and facilitate their pedagogical practices. Is this a bad strategy, after all? I don't really know whether it is totally good or totally bad; rather I know that this approach is making sense to them and helping me know what I am doing for my class and where I am leading it to.

Contd…

Why am I arguing
for leaving elitism-promoting practices?
Why am I advocating
for students' participation?
Why am I disrupting
the worldview of exclusion?
Why am I supporting
an inclusive mathematics education?

Why am I questioning
the view of intelligence as ability to recall?
Why am I critiquing
the tendency to exclude the 'contextual'?
Why am I challenging
the view of logic as a quest for certainty?
Why am I resisting
the ideology of reproduction and hegemony?

Why am I arguing
for going beyond essentialism?
Why am I advocating
for a majority-benefiting vision?
Why am I disrupting
the one-size-fits-all curriculum image?
Why am I supporting
co-existence of opposing views?

Sitting at the back of the classroom as the tutor of Mathematics Education, I eagerly wait for today's presenter to take over the vacant space in front of the classroom. "The presenter seems to have forgotten his task today. Maybe he is busy having a wonderful Saturday picnic," a student makes fun of his delay. "We still have ten minutes to start. So he may be busy photocopying the slides," I say on a positive note although I am also doubtful because of his apparent passivity toward the discourse *that has been taking place in this class. Although the students seem to buy into my ideas, I begin to worry about his possible absence which requires me to develop an instant plan of action that <u>should</u> engage these eight experienced teachers for the next three hours. Thus, I start sketching a contingency plan as though I am on a rescue mission. In a moment, however, I hear a knock on the door and the presenter enters the room.*

Pratap, with the support of a technology assistant from the university, sets up his presentation. Not knowing the detail of Pratap's presentation, I open my notebook to remind me of his topic. It appears that he is going to share his (renewed?) views of mathematics curriculum, pedagogy and assessment – a fairly open theme left to the last presenters. Observing his total engagement in the task, I suspend my recently held belief about him as potentially a less motivated student. In the meantime, getting hold of the assigned reading materials, Pratap starts showing his slides with a written explanation that he reads out during the presentation of each slide.

Pratap's first bullet point -- that a precise curriculum helps make teachers' task trouble-free – gives an indication of his notion of curriculum. My ear receives an (un)expected perspective that Pratap's notion of precise curriculum is meant to be a list of subject matter to be taught. He then explains briefly how different mathematical concepts <u>should</u> be sequenced according to the hierarchy of grades. He un/wittingly critiques our ongoing discourse on socio-cultural and political aspects of mathematics curriculum, thereby promoting a reductionist view of curriculum as exclusively a list of subject matter. I feel like I have had a stone in my food. "Mathematics curriculum <u>should</u> state one thing very explicitly: what to teach. It should not distort the pure nature of mathematics because our students need to understand the purity of mathematical knowledge. It is okay to mention about the how aspect if there are some mathematically correct teaching methods designed for particular topics. In general, the how aspect is not that important as it is embedded in each mathematical idea and concept," Pratap reminds me of one of my university professors who called mathematics education units 'mathematical blasphemies'. I tighten my mouth knowing that I have to facilitate a follow-up discussion on the basis of what is coming out of Pratap's ignorant verbal shooting display.

Pratap's slides on mathematics pedagogy gradually smash against our recently accumulated collective consciousness that students' meaningful participation in *mathematics learning is central to a meaningful mathematics education. Pratap explains why he thinks that his short-cut method of doing mathematics (teaching mathematics?) should be followed by all teachers. "First, the short-cut method helps clarify mathematical facts, formulae and theorems to the students. Second, the short-cut method is easy to remember by students, thereby developing correct understanding of mathematical subject matter which is essential for their higher studies. Third, the short-cut method is appropriate to Nepali classrooms where a single teacher has to teach classes with more than fifty students," Pratap appears to counter all the previous presenters who have begun to subscribe to a progressive and multi-perspectival and inclusive view of mathematics pedagogy. Despite hearing his regressive posture on inclusive mathematics curriculum and pedagogy, I try not to change my facial appearance so as to (at least) encourage one of the most passive students to put forth his perspective in front of the classroom. Have I been able to maintain a smiling face in such a mockery-like presentation? I doubt it.*

(sound effect out)

It is nearly twenty minutes since Pratap started his presentation. Without any surprise, Pratap articulates his view of assessment as an activity detached from day-to-day teaching learning activities. He goes on to say that student achievement in mathematics should be decided solely on the basis of their performance in written tests. "The existing system of assessment should be enhanced further so as to develop a more reliable and valid testing system in mathematics education. I think the idea of task-based, authentic, and portfolio assessment does not assess mathematical knowledge that we need to develop in our students. In the end, each student should be able to find the correct answer of each mathematical problem," Pratap speaks as if he is an Avatar of an exclusive reductionist thinker who treats students as objects of mathematical instruction.

As Pratap is about to conclude his presentation, I begin to imagine yet another Everest to climb in the near future, that is, facilitating Pratap to become conscious of his narrow view of mathematics curriculum, pedagogy and assessment. If he recognises disempowering limitations of his viewpoints he may begin to think about other perspectives. Perhaps I need some strategic and pragmatic discourses that may challenge the prevailing status quo in Pratap's reductionist worldview of mathematics education, helping him to embrace an inclusive view of mathematics *education. Will this really happen in the near future or is it likely to remain my unfulfilled aspiration? (**sound effect: slow drumbeat for about 45 seconds. curtain falls**)*

CURTAIN RISES

Act 2: Prologue

NARRATOR : *(stands)* I would like to start this performative chapter with the notion of "the *deliterization* of knowledge" (Eisner, 2008, p. 5) as a means for challenging the reductionist view of knowledge as warranted assertions arising exclusively from evidences collected from an 'out there' field. In challenging such a view of knowledge I have used various performative genres so as to explore different meanings of reductionism arising from my experience as a teacher educator. The story, *Precise Curriculum, Short-Cut Method and Standard Examination,* constructed on the basis of my experience of working with (or tutoring) in-service teachers, is a basis for creating an extended plot with a number of characters who unpack deliteralized meanings of reductionism and its implications for mathematics education in Nepal.

Given the notion of deliterization of knowledge, the episode progresses through a number of *Acts.* Whilst detouring to reductionism as ideology, I encounter its victim-blaming attitude and uni-dimensional view of mathematics education. Next, I, together with other *performers,* elaborate my view of methodological reductionism as an approach to reducing complex paradigmatic (and epistemic) issues to fixed instrumental procedures. Furthermore, in my quest for understanding the notion of reductionism as methodology I employ a bricolage of narrative, reflective, poetic and storied performances hoping to unpack multiple (e.g., literal, metaphorical, lived, felt) meanings of reductionist methodology. Subsequently, the notion of reductionism as logic becomes a major theme of *Act 5*, thereby providing readers/viewers with an opportunity to experience my voices through the character, *Narrator*. In so doing, I try to depict, literal, lived and felt meanings of reductionist logic. Toward the final *Act* of this chapter, I recapitulate the historical route of reductionism via interpretive, poetic and dialogic performances. (***curtain falls. the Narrator is seen walking backstage. the stage light is still on.)***

CURTAIN RISES

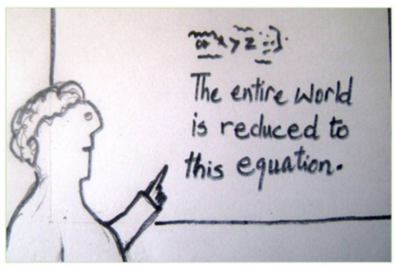
Act 3: Encountering Reductionism as Ideology

STORYTELLER: **(appears in a long robe and turban. has a wand-like object attached to his left arm. *sits)*** *One of the Secretaries to the Master Magician informed me that I was qualified to enrol in a nearly month-long course on conducting magical performance. 'A course with a magician?' I murmur to myself with awe and enthusiasm as I followed a narrow pathway leading to a castle-like building. Although I cannot remember its exact location, it could be somewhere on a remote and uninhabited island. The building was very cold inside and I felt that my body was going to freeze soon. But as I saw many people in a similar situation, I began to assimilate myself in that rather unprecedented environment. After some days, we were all directed to the special room where we would be initiated into the Universal Magical Cult by the Master Magician who was to lead the ceremony of initiation with the help of Brother and Priest Magicians. As the initiation ceremony began, the Master Magician ordered us to repeat this mantra seven times: I hereby proclaim that I am committed to magically condensing big and complex ideas into simplistically measurable and performable magical actions. After our repeated vows, the Master Magician started his lengthy lecture aimed at helping us understand the philosophy of the magical cult. Following a week-long orientation session, we were referred to a group of Brother Magicians who would guide us to design a magic performance. (Journal entry, September, 2008)* ***(curtain falls.)***

CURTAIN RISES

NARRATOR: (***stands. the adjoining sketch (Omnipresent Reductionism) appears on the flannel board next to his chair***) In this detour of my journey, I am portraying my encounters with the metaphor of *reductionism as ideology*. I have chosen the term 'encounter' so as to depict the emergent nature of my inquiry. When have I encountered reductionism then? I am encountering reductionism right now as my intellectual mind-body appears to be un/wittingly colonised by the prosaic-analytical text as a sole means for representing the entirety of my experience and imagination. I encounter the hegemony of reductionist ideology embedded in educational research when I open my ‘inbox’ to read emails from other researchers filled with questions like these: *Are you going to use specific software that helps reduce your texts to themes? If not, how do you analyse them? What are your key hypotheses?* Even in the process of constructing this Episode, I have postponed the writing task on several occasions as a result of my suspicion that I might be practising reductionism whilst critiquing it. Then, I quickly realise that I am embracing multi-textualities and a bricolage of multiple genres and logics. So, why should I be so suspicious of my performative texts? Consequently, my fingers make movements over the keyboard with a view to gaining some insights into meanings and natures of *reductionism as ideology* and its possible dis/empowering posture in developing an holistic and inclusive mathematics education in Nepal.

Reflecting upon Pratap’s ideas about curriculum, pedagogy and assessment embedded in the signature story – *Precise Curriculum, Short-Cut Method and Standard Curriculum* – of this Episode, my writerly selves try to visualise the meaning of reductionist ideology embedded in Pratap’s thinkings as an in-service student teacher. **(*points to the poster, Omnipresent Reductionism*)** Perhaps, the poster (representing the background of the stage) represents one such meaning of reductionist ideology: that mathematics education <u>should</u> privilege infallible symbols and equations, thereby discarding lively mathematics arising from people’s cultural practices. Does this mean that my story character, Pratap, has promoted a reductionist ideology through his view of curriculum, pedagogy and assessment? In what ways is this ideology manifested in Nepali schools?



Omnipresent Reductionism

(sits) Leaving you to search for possible answers to the first question, I am taking up my journey with the second question which encourages me to search for contextual meanings of reductionist ideology. Which epistemic warrant can I use for unpacking the manifestation of reductionist ideology in Nepali Schools? Perhaps, I had better used my experience of working with in-service teachers so as to perform a semi-fictional letter from my story character, Pratap. Hopefully, such a letter demonstrates how reductionist ideology controls the lives of teachers and students. ***(curtain falls.***

the director makes an announcement that the character Pratap is performing next.)

CURTAIN RISES

***PRATAP**: **(sitting on a chair)** It can be any day in 2004. Mr. Cutback, the school principal, summons me to his office for a brief meeting. I do not know the meeting agenda then but I have a feeling that he is going to talk about the six grade ten students who he wants to include in the list of 'private students'. He wants to do so because these six students may fail in the SLC examinations. By putting them under the category of private students, he will have potentially better students who can perform well in the SLC exam. (**coughs**) By having all students pass in the SLC exam he can attract many students for the next academic year.*

As I enter the room, Mr. Cutback indicates that I take a seat on the couch. "Maths Sir, have you thought of any alternatives for these disgusting dumb students?", asks Mr. Cutback, showing the list of students which I have thought to be the agenda for our discussion. Since I joined International Standards Secondary School in the middle of 2001, I have learnt to speak according to the mood of Mr. Cutback, who is the principal of the school. "We need to ask their parents to fill in the students' SLC-registration forms as private students", decides Mr. Cutback and I nod. "These students are solely responsible for not being able to demonstrate good performance in mathematics despite my efforts. And, their parents are pathetic?", Mr. Cutback releases his blameful language, expecting me to nod to his every word and sentence (walks to the right).

In the next episode of our meeting Mr. Cutback starts blaming some mathematics teachers who, he believes, are not delivering well. In the meantime, I remind him of the promise that he would buy some essential materials for mathematics teaching. "I don't think that these materials are important. Each class is well equipped with a good chalkboard and well patterned desks-benches. Is this not enough for mathematics teaching? Why do they need such fancy materials for the teaching of mathematics? For me, mathematics is all about finding correct answers by using appropriate methods." Mr. Cutback does not admit that he is also blameworthy for not standing up to his promise. Doesn't he subscribe to a reductionist ideology for *managing the school? Do I also embrace such a reductionist ideology? Perhaps, I continue this until the end of 2004!* ***(curtain falls. Pratap exits backstage.)***

CURTAIN RISES

NARRATOR*: (sits on a chair)* After demonstrating (hopefully) some contextual renderings of reductionist ideology, I would like to draw your attention to Steven Rose's (2003) book, *Lifelines: Life beyond the gene*, that offers a definition of *reductionist ideology* as the view that higher order complex phenomena are explained exclusively in terms of their lower level properties. Here, Rose being a biologist and me being a mathematics educator does not separate us, as our concern appears to be the same – *the biosphere.* In my solidarity with the holistic biologist, I hold the view that mathematics education is a discourse and system of inquiry about and within the biosphere. Perhaps, Rose's enunciation of reductionist ideology and stories of my experience give rise to two possible implications for Nepali mathematics education that: (i)) it cultivates a mechanistic view of mathematics education that all visions, views and perspectives are necessarily reduced to some fixed technical procedures; and (ii) it is often translated into an extreme form of victim blaming ideology that ignores political, social and systemic weaknesses, thereby holding individuals situated at the receiving end of the education system entirely accountable for their failure. Similarly, Brent Davis (2005) argues that the Euclidean model of thinking is a key source of reductionist ideology in mathematics education, as this model reduces all possible mental and visual imagination to a plain geometry — a geometry of zero curvature. Connecting my experience as a teacher educator with Davis's perspective as a researcher, I find that reductionist ideology has been hegemonic to Nepali mathematics education by (i) privileging Euclidean Geometry in school mathematics curriculum, (ii) using Euclidean Geometry as an invisible framework for thinking about mathematics pedagogical models, and (iii) being exclusive to other forms of thinking (geometric) models that can help generate an inclusive mathematics education. ***(drinks a cup of water. coughs gently.)***

(stands) Thus, I come to realise that a reductionist ideology is an obstacle to envisioning fully an inclusive and holistic mathematics education in Nepal. I envisage that such an obstacle manifests in three possible ways. First, reductionist ideology prevents mathematics education from being an emergent domain of inquiry, thereby reducing it to an unchanging discipline via the image of *curriculum as subject matter*[42]. Second, such a reductionist ideology is likely to endorse the existing view of infallible (i.e., pure) mathematics. Finally, the metaphor of *reductionism as ideology* does not seem to be helpful for me and other Nepali teacher educators in cultivating multiple, interconnected and hybrid identities. If mathematics teachers and teacher educators are denied their quest for searching for multiple identities, how can they be prepared for an increasingly hybrid (see Section Two) and multiplistic space of an inclusive and holistic mathematics education? ***(the fall of curtain indicates the conclusion of Act 1. the Director makes an announcement that the performance will continue in some minutes.)***

CURTAIN RISES

Act 4: Touring with Reductionism as Methodology

STORYTELLER: ***(wearing a neck-to-foot black robe and carrying a big suitcase that might contain a manual for designing some magical actions)*** *Next day, we were taken to a downstairs seminar room where a group of Brother Magicians were ready to serve us as guides. It was almost a one-is-to-five ratio between the Brother Magicians and the newly inducted cult members. In the meantime, a mature-looking Brother emerged and shared the modus operandi for the magic design sessions. We would be staying there for seven Earth-days under the tutelage of Brother Magicians who were going to teach us the secret design formula. In the meantime, the newly inducted cult members were divided into a number of groups. Our group consisted of five members who were given a structure to design each of our magical performances. We were told that the structure could not be changed in any circumstances. Each Brother warned us not to be over smart and creative as smartness and creativity would not help complete the pre-designed magical performance. I saw two of my group mates being cautioned for their creative trials of*

[42] In my experience, the widespread belief in the field of Nepali mathematics education is that the 'subject matter' of mathematics is considered to be unchanging. This view of the nature of mathematics helps reduce the complexity enshrined in designing and implementing the image of *curriculum as subject matter*.

designing their magical performances. The Brother Magician, who was facilitating our group on the fifth day, reminded us: reduce your big ideas to some procedural activities which can be measured precisely. And, don't ever try to change this plan once you start your magical performance. In this way, we were being educated about the core beliefs and views of the Universal magical cult. (Journal entry, September 2008)

(curtain falls. the backstage is marred by confusion and chaos. "Oh, the log sheet is missing." The anxious tone of the director entertains the audience in the front row. "Perhaps, there is a drama within the drama", comments a middle-aged man laughingly.)

CURTAIN RISES

NARRATOR (sits on the chair. the poster, Cartesian Design-Trap is pasted on the curtain behind him.) : Galvanised by the notion of inquiry as magical writing, I quickly construct the meaning of the metaphor of reductionism as methodology arising from the assumption that parts have ontological and epistemological primacy over wholes (Rose, 2003; Wrigley, 2004). Here, the notion of methodology entails processes, protocols and procedures that facilitate ways of knowing. In the field of mathematics education, the aspects of curriculum designing, teaching, assessing and researching can be considered as the domain of methodology. In my mind a reductionist methodology embedded in Nepali mathematics education portrays the process of curriculum development as prescribing a list of subject matter and teaching methods. Speaking from my reflective warrant, I find Tyler's Rationalistic Model[43] being considered as the regulative principle for designing the mathematics curriculum of Nepal. What does the qualifier term 'rational' indicate here? I come to realise that Tyler's model

Cartesian-Design Trap

43 Ralph Taylor's Objective or Rational Curriculum Model prescribes four major steps for curriculum development. These are: 1) deciding the educational purposes or objectives of schooling, 2) selecting appropriate learning experiences, 3) organizing the learning experiences for effective instruction, and 4) evaluating the effectiveness of learning experiences (Tyler, 1949).

does not espouse a Rortian view of rationality as persuasion, curiosity and acceptance, which are essential for conversations involving different viewpoints (Niznik & Sanders, 1996). Rather Tyler seems to promote rationality as a means for prescribing a 'final truth' about curriculum designing. Perhaps, Tyler's prescriptive model tries to convey the message that being rational is about reducing the entirety of the curriculum process to some measurable objectives, learning experiences and evaluation methods (Slattery, 1995). Nevertheless, I am not dismissing the need for measurable objectives, classroom activities and evaluative methods, rather I am critical of the reductive notion of measurement which is not inclusive of complexities enshrined in mathematics learning and assessment-related activities. Unpacking some disempowering meanings of reductionist methodology thus far, I am inviting you to watch Pratap's performance so as to understand how he experienced reductionist methodology as a teacher and department head. ***(curtain falls.)***

CURTAIN RISES

PRATAP (a low-volume sound effect: classroom context; Pratap is solving an equation to grade ten students) :(sits) *Dear Tutor! The story, Precise Curriculum, Short-Cut Method and Standard Examination, seems to represent the way in which I presented myself in your class. Perhaps, you are correct to say that I promoted a reductionist posture through my presentations on contemporary issues of mathematics education. The purpose of this performance is to let you know about key obstacles that led me to act as a resistant student to your inclusive view of mathematics education.* ***(stands)*** *Besides this, I would like to respond to my (and your) emergent questions: Why did I act in that way? In what ways, did the metaphor of reductionism as methodology inform my practice as department head and teacher?* ***(sound effect out)***

Having worked closely with Mr. Cutback, I was distancing myself from teachers and students. ***(speaks loudly)*** *As department head, my activities were oriented toward controlling mathematics teachers and students as per the agenda of Mr. Cutback. "All students should pass the SLC exam with minimum of first division." This was the mantra of my epistemology of practice as a teacher and the department head. I still believe that this is not a wrong mantra altogether, rather the reductionist worldview embedded in it was highly exclusive of other aspects of education.* ***(walks***

two steps further to the left) *As I was imitating the language of Mr. Cutback, mathematics teachers were criticising me for not being able to understand complex factors associated with the success and failure of students. Nevertheless, teachers were not using an informed language of holism, rather they were critiquing my approach of designing departmental plans and activities. "What kind of teacher are you? How can you simply say that I am totally held accountable for the failure of three students?"* ***(sits on the chair)*** *A teacher who was teaching middle school grades was opposed to the ruthless reductionism prevailing in my practice as department head. In this moment I reflected somewhat superficially upon my epistemology (and methodology) of practice: "Why do I reduce the complex notion of teaching to preparing students for the SLC exam? Why do I blindly opt for structured lesson plans and didactic method? "*

I began to realise that I was acting upon Mr. Cutback's interests. Initially, I was attracted by Mr. Cutback's idea of 'clear and precise approach' to teaching. Perhaps, I held a similar view of teaching mathematics at that time? After three months of my career, Mr. Cutback chose me as the messenger of this approach by appointing me as the department's Head of Mathematics. ***(winks and flushes)*** *Why? Perhaps, because I could be a good person to execute his narrow ideas as I believed that mathematics teaching is about the transmission of knowledge.* ***(stands and walks around)*** *Although I never asked Mr. Cutback about his definition of 'clear and precise approach', I came to know in a few months that his meaning of such an approach was an intention to control each school activity via a set of manageable and instrumental actions.*

As I was completing the third year of my teaching career, a feeling was coming to me that I wanted to update my knowledge as my plan to continue my postgraduate studies in mathematics was in limbo. But I was not sure about the type of knowledge I needed and wanted. ***(sits and scratches his head)*** *In the midst of the conflict between my needs and wants, I joined the one-year teacher education program offered by the University of Himalaya. What type of course/unit was I expecting? Ironically, I was imagining 'algebra and analysis' kind of 'content' would be included in the course. The first four months of the teacher education program were a transition period for me: I was struggling (frustratingly) to revise (at least) my* *archaic-reductionist idea as the sole referent for my methodology of practice as a teacher, and learner.* (***curtain falls)***

CURTAIN RISES

NARRATOR: ***(stands)*** In holding an holistic perspective of education, I argue that reductionist methodology, which is widespread in the field of mathematics education, has played a key role in reducing mathematics to a homogenous, pure and unchanging discipline. Such a reductionist view of mathematics discards an ecological view of knowing as embodiment of mathematical knowledge in cultural practices, thereby promoting pedagogy of 'knowledge imparting' which is akin to the ideology of Industrial Trainers[44] who endorse the authoritarian aim of education as the imparting of decontextualised and academic-interest-serving knowledge (Ernest, 1991). Thus, an exclusive notion of teaching as knowledge imparting does not provide room for meaningful participation of students in teaching and learning activities. Guided by such a reductionist methodology of conceiving the notion of teaching, Nepali mathematics teachers are likely to exclude mathematical practices arising from students' lived experiences. Therefore, privileging such a disempowering view of pedagogy in designing lessons, Nepali mathematics education un/wittingly endorses a narrow view of intelligence as an ability to rote memorise and recall the knowledge imparted by the curriculum and textbooks.

(sits)Arriving at this stage, I argue that the epistemology from which reductionist methodology arises does not seem to allow an emerging approach to knowing, being and valuing. Primarily, such a methodology of knowledge claims is potentially guided by a realist ontology which promotes a correspondence theory of truth, that is, truth is the one-to-one correspondence between reality and mental images without being infected by the knower's personal, political and cultural qualities (Taylor & Wallace, 2007). What can be the epistemology that is guided by such an ontology of reductionism? It is the epistemology of positivism (and positivism-inspired

[44] The social group of Industrial Trainers promote dualist/absolutist ideology of mathematics. Their description of mathematics education constitutes hard work, drill and practice, competitiveness, and no consideration for social issues.

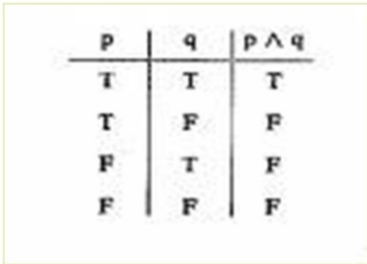
paradigms) that reduces knowledge to an exclusively objective, pure and tangible form (Kauffman, 2007). The following poetic reflection gives a glimpse of how a researcher is restrained by a reductionist methodology from capturing a whole picture of reality ***(stands)***.

How can you use your voice?
How can you go beyond pre-conceived device?

This is research. You are doing science.
Don't ever try to go away from your course.

Research is all about probing variables
A 'handful of them represents the whole system'
This is the mantra. Attach to your database
Be a robot-like person as you play with numbers

Words are fuzzy and sentences are clumsy
Use numbers and equations for clarity
Avoid metaphors, similes and stanzas
Cut and dry should be your language



p	q	p ∧ q
T	T	T
T	F	F
F	T	F
F	F	F

Reductionist Truth

(sits) I am not denying that the image of *reality as nihilism* offered by an extremely deconstructive form of postmodernism is likely to promote yet another form of ontological reductionism that may promote a narcissistic epistemology (Kincheloe, 2005). Furthermore, an exclusive postmodern epistemology of *knowing as ironic gazing* is likely to over celebrate the ironic aspect of language, thereby reducing knowledge to an exclusively subjective, fluid and fragmented form. This strong postmodern approach to knowing is likely to reduce my 'self' to a symbol that becomes a subject of narcissistic gaze. Here, my notion of narcissist gaze is an approach to limiting the world to within the realm of the self image. ***(curtain falls.)***

CURTAIN RISES

Act 5: Experiencing Reductionism as Logic

STORYTELLER: ***(sits on the chair. the poster, Reductionist Truth, is pasted on the curtain behind him.)*** *Toward the end of the seventh day we all were told by a Brother Magician that we needed to spend another week working with a group of Priest Magicians who would help us use some key tools that are required to produce impeccable magical results. We then moved down to the flat where Priest Magicians had their workshop. A thin-bodied Priest Magician appeared at the door to welcome* *us. The workshop was full of 'tools' that could help our magical rituals be successful. We took a rest for about twelve Earthly hours before starting yet another weeklong hermitage for preparing ourselves as the most revered magicians in the universe (well we had reduced the universe to Earth and its periphery). We wake up to the announcement that we had to be ready in no time as the chief Priest Magician was going to inaugurate the workshop. We entered the room full of magical tools and took seats according to our nametags. Whilst the chief Priest Magician ascended the podium, other Priest Magicians were busy distributing a pack of three major tools -- a speaker, a sledgehammer and a knife to all of us. I become very curious about the potential use of these awkward tools. "How am I going to be a magician ever with these alien tools?", I murmur to myself, being utterly unconvinced by the nature of the tools. In the meantime the Chief Priest introduced the tools: "Remember, the speaker that you have now helps you speak loudly and certainly. In your magical performance, there is no room for low voice and any traces of uncertain statements. The sledgehammer helps you compress fuzzy and complex elements arising in the magical process. You will be using the knife to cut and discard the non-affirmative aspect arising from your magical performance. I now command you to follow other Priest Magicians so as to learn to use these tools according to the guidelines of Universal Magical Cult." In this way, the seven-day workshop came to a conclusion, encountering some deadly scenes of magical performances*. ***(curtain falls.)***

CURTAIN RISES

NARRATOR: ***(sits on a chair, making the poster visible to the audience)*** In order to generate meanings of the metaphor of *reductionism as logic*, let me explore some of its salient features. First, the logic of reductionism appears to use an extreme form of analytical thinking (e.g., yes versus no, pure versus impure mathematics, teacher centred versus student centred pedagogy) which gives rise to many unhelpful dualisms (see Section Two). Reflecting upon my practice as a teacher educator and researcher, this feature of reductionism as logic often prevents me from helping teachers realise fully the importance of multiplistic and holistic modes of thinking and actions.

(drinks a half-cup of water) Second, the metaphor of *reductionism as logic* seems to privilege an exclusively linear-casual model facilitated by propositional, deductive and analytical logics[45] that account for a few factors of a system by allocating excessive explanatory weight to them. In the context of mathematics education, this linear-causal model is less likely to account for hidden and emerging factors and variables that might be significantly impacting the education process (e.g., relationships between knowing, being, valuing) (Davis, 2008; Taylor, 1998). After hearing my critique-filled description of the second feature of the metaphor of reductionism as logic Nepali teachers may raise this question: *Are you suggesting that we replace the causal pedagogical model in Nepali classrooms?* No, my intention is not to replace the linear causal thinking model. Instead, I would like to cultivate emergent pedagogical models so as to embody inclusion and holism. As I write these sentences, a question is likely to challenge my integrity as a tutor: To what extent did you stay away from reductionist logic? Perhaps, the following performance of my 'tutor' avatar responds to this question. ***(curtain falls. the director calls TUTOR so as to lead the performance.)***

CURTAIN RISES

TUTOR (sound effect: TUTOR makes presentations on ethnomathematics; one student raises the question: is ethnomathematics equally credible as official mathematics? TUTOR responds to the question…): (sits on the chair. the volume of the sound effect is lowered) Dear Pratap! Thank you very much for your performances. They have helped me understand your professional situatedness which might have caused you to act in a particular way in my class. In this performance, I am not talking exclusively about you, rather I am also reflecting upon my own pedagogy in relation to logics that I employed to facilitate the unit, Mathematics Education. Thus, the text in this letter moves between you and me, at times scrutinizing either of our situatedness as a learner and facilitator of the unit.

(sound effect out. stands.) *As I begin to perform this reflection, I remember the very first day of the class in which I handed the unit outline to you. All of you were*

[45] Propositional logic is about making a declarative language that can be depicted either yes or no whereas deductive logic is about using ethereal law-like statements to map down particulars.

*surprised by encountering many unusual terms mentioned in the unit outline. "Is this a '(pure) mathematics' unit or a unit on sociology/ anthropology?" My response to your question was: "This is not a unit on (pure) mathematics, rather this unit deals with issues about mathematics education, such as curriculum, pedagogy and assessment. The main purpose of this unit is to explore ways to conceive the curriculum, pedagogy and assessment that promote meaningful and inclusive teaching and learning activities." Our exchanges were setting apart our 'selves', thereby creating a borderline between our contracted egos as a facilitator and a student of the unit. The second day didn't help us to develop good terms between us either. You resisted my views about the active involvement of students in teaching and learning activities. I countered your view. (**speaks passionately**) We then imputed these views upon our identities, thereby preventing us from engaging in meaningful dialogues. Other students rallied behind my ideas. Probably, from the third and fourth class you became somewhat passive. You did not involve actively in most of the classroom activities. (**appears thoughtful**) You and I waited for the next four months to realise each other's potentials as persons.*

*(**sits**) I am reflecting upon my own logics as a tutor. A confessional self in me suggests that my 'tutor self' was interested in retaining control over the unit. To do so, I used some aspects of reductionist logics. I might have used propositional logic, embedded in the assertive language game to demonstrate that my ideas were superior to the ideas held by others. Why did I use propositional logic? (**stands**) Perhaps, the prevailing logic of the mathematics education community is the logic of proposition. Perhaps, propositional logic could help me convince easily that an inclusive mathematics education is better than a reductionist-exclusive mathematics education. Whose interests did I best serve, then? I could claim in a conventional sense that the ideas (i.e., content) included in the unit were about serving the best interests of the learner by making mathematics meaningful, applicable and inclusive. (**speaks gently**) But, did my pedagogy serve the interests of my students? At least, I could not serve your interests, could I? (**sits**) Whilst un/wittingly using the reductionist logic of proposition, we were potentially forgetting the power of a dialogic pedagogical space that would allow both of us to cultivate new meanings. Did my critical view of Nepali mathematics education sound like your personal critique? Perhaps it appeared that I was saying that all of you were having a false*

consciousness. Of course, I could have applied the ethics of care and inclusive logics that would have helped me empathise your pedagogical hardship. And you could have reciprocated. On the contrary, your silence and passivity might have generated a narrow analytical logic that Pratap was wrong and the lecturer was right.

*(**stands**) Dear Pratap! Arriving at this stage, I am also critically reflecting upon your posture as a learner in our class. You could not release yourself from the grip of reductionist logics that potentially helped you define or defend the exclusive notion of teaching mathematics as controlling students via the reductionist logic of proposition, deduction and narrow analytic (see Section Four of this thesis).* ***(smiles with wide eyes)*** *Perhaps, your notion of knowledge giver and receiver was very much entrenched in your thinking and actions as a teacher. Your initial disliking of my assignment of preparing lesson modules incorporating culturally contextualised examples of mathematical concepts could have been the result of your unquestioning celebration of the certainty and purity of mathematics.*

*(**sits**) In the final paragraph of this performance, I admit that we could have put our tentative agendas aside and had a meaningful dialogue as human beings. Perhaps, we both failed to turn our egos to ourselves, thereby separating with the labels of conventional student and radical tutor. For me, an egotistic attitude is likely to cultivate the logics of reductionism that sets us in a narrow space of thinking and acting.* ***(curtain falls. TUTOR walks backstage)***

CURTAIN RISES

NARRATOR***: (stands.)*** Therefore, the metaphor of *reductionism as logic* promotes the idea of *control* which plays an important role in generating arguments. Also, the feature has close relationships with the metaphor of *language as non-porous object*[46] which is a stumbling block for embodying the poetics of inclusion and holism in my inquiry. Furthermore, the idea of 'control' can be responsible for promoting a static

[46] The metaphor of *language as non-porous object* is an Emersonian critique of the positivistic notion of seamless mono-textual language (Section Five).

and essentialist view of mathematical knowledge. As I enunciate these features of reductionist logic, a number of questions compete for occupying this space of textual creation. What are likely to be key logics that promote reductionism? In what ways are such reductionism-inspired logics likely to promote a culturally exclusive view of mathematics education? Section Four of my thesis addresses some of these questions**. *(curtain falls. The director makes an announcement that the next Act begins in 15 minutes.)***

CURTAIN RISES

Act 6: Understanding Reductionism through History

NARRATOR: (*stands. puts his left hand on the table.*) With the notion that writing about history is not an error-free exercise, I am searching for tentative answers to these emergent questions: Why has reductionism become so hegemonic in mathematics education in Nepal? What are the potential routes of reductionism that makes Nepali teachers (like Pratap) embrace it un/wittingly? Looking at the history of Western philosophy, it appears to me that some of the early Greek thinkers used the notion of reductionism to explain the world through its lower level properties, such as water (Thales of Miletus), apeiron (Anaximander of Miletus) and air (Anaximenes of Miletus) (Guthrie, 2003). After the logos-centric idea became central to Greek consciousness, some traces of reductionism appeared in the work of many mathematicians and philosophers, including Pythagoras, Plato, Euclid and Democritus. Indeed, the idea of *logos* itself might have contributed to a reductionist method of knowing about the universe because of the belief that only *logos* could enable humans to know the governing principles of the cosmos. The Enlightenment logic of narrow analytic, a hallmark of Newtonian scientism, can be regarded as an avatar of the Greek approach to reasoning, *logos*. Perhaps, I will not be doing justice to my textual weaving of the history of reductionism if I do not mention the Aristotelian syllogism which retains an unparalleled influence on the Western Modern Worldview as a source of reduction (inductive and deductive reasoning). However, it is not my claim (if I can make any) that Aristotle can be held responsible for developing reductionist logics. His work of *phronesis* and passion appear to be left out, thereby attributing him as the pioneer of reductive logical approaches (Magee, 1987). Perhaps, Aristotle would respond to the overly reductionist representation of his contribution through the following poem ***(looks pointedly to the audience. walks to the edge of the stage and begins)***.

The Teacher of Alexander. The student of Plato.
I am Aristotle. But I am different from these two.
I have penned on logic, virtue and phronesis
I have cautioned people for being professionals

Passion, I have requested to cultivate
Practical knowledge, I have asked to promote
I am tired now. People are so blind using my syllogism
That was merely a component of my creation

I tried to depict the cosmic process through causality
But I have also talked about chance and spontaneity
I argued for empiricism not staying away from rationalism
I talked about logic not separated from poetic vision

(sits)The Enlightenment project, which begins in the middle of the second millennium, appears to harvest a number of reductionist approaches via scientific and mathematical inventions. The works of Copernicus and Galileo, on formulating mathematical equations as the descriptor of their innovations, seem to provide a basis for highlighting reductionism as the uncontested method for the study of the natural (and social) world. However, it is contextual to note that Copernicus used poetic imageries to describe his revolutionary ideas (Hallyn, 1990). Sadly, this portrait of Copernicus appears to be assaulted by the exclusive reductionist image that Copernicus relied solely on numbers, equations and reductive algorithms. Similarly, Galileo's metaphorical and discursive approach, as demonstrated in some of his writings (Galilei, 1960), has been stripped away as a means for representing the pure scientist who reduces the natural world to one-line laws and equations.

(stands) With the advent of the Newtonian mechanistic worldview, reductionism became a major approach to the study of science. The role of (Europeanised) mathematics appears to have been paramount together with its emphasis on concise (reductive) symbolism and algorithm. The mechanistic approach to looking for minimum sets of laws, according to which the functionality of the universe is explained, continued to grow by ignoring the dynamic emergence/contingence of knowledge. In the passage of time, the reductionist ideology began to shape European education so as to prepare citizens with discrete skills and knowledge required for industrial society. A similar reductionist model of education (especially science and mathematics education) appears to have been transported to their colonies around the world with the view that such an education system could produce students native in colour but European in outlook (Loomba, 1998).

Looking at the history of mathematics (e.g., Boyer & Merzbach, 1991), I encounter an interesting perspective about the development (if this is regarded as so) of mathematical representation which, I believe, is based on a reductionist perspective. Rhetorical mathematical representations of pre-Greek traditions (and also non-Greek traditions, such as Indian, Chinese and Japanese) are regarded as primitive forms of mathematics. For me, there can be three reasons for rhetorical representations to be labelled as primitive: (i) these representations do not use European symbolisms; (ii) they do not separate *mathematics* from mundane texts; and (iii) these representations are thought to be communal, holistic and local because they seem to promote non-Eurocentric worldviews. Many historians of (Western) mathematics classify the syncopated form of mathematical representations as being little advanced whilst attributing the symbolic form of representation as being fully developed representation. Through this historical sketch, I (and you) can see a general pattern that reducing mathematical ideas to symbols is the main feature of modernist mathematics. Does this not mean that reductionism is the orienting perspective of modern mathematics?

(sits) Although Europeans contributed to the length and breadth of mathematics in developing it to its present form, recent studies have shown that they possibly (mis)appropriated mathematics from non-European traditions and then Europeanised them (Almeida & Joseph, 2007; Joseph, 2000). Possibly, the process of Europeanising mathematics from non-European traditions entailed: (a) collection of mathematical knowledges from around the world, (b) assimilation of them according to the Western Modern Worldview, and (c) dissemination to their colonies of the processed (if it is really an act of processing) mathematical knowledge as the only valid mathematics. It appears to me that the heart of Europeanizing mathematical knowledge is, inter alia, symbolisation, an act of reducing differing mathematical knowledge traditions to a set of finite and fixed symbolic (and algorithmic) systems. You can raise a question here: Am I rejecting reductionist Europeanised mathematics? No, my intention here is to unpack the disempowering political past of modern mathematics, thereby exploring possibilities for incorporating mathematics arising from Nepali people's cultural practices in mathematics education so as to create an inclusive synergy of contextual (i.e., impure) and universal (i.e., pure) mathematics. The following poem illustrates my view of the relationship between *modern mathematics* and mathematics embedded in non-Western cultures. ***(stands)***

I know it is through the algorithm of modern mathematics
Aeroplanes take off, fly over and reach their destinations
Every database works perfectly with minimal errors
Traffic management becomes smooth with safely running cars.

How can I harness this benefit of modern mathematics?
Perhaps, decontextualised teaching is a futile act.
Linking with my cultural contexts makes better sense
Modern mathematics can be one of 'many mathematics'.

We also have a share of you, modern mathematics
As many ideas were integrated into you from East and South
Although acknowledgement has not been received
I still think that you are part of me. You cannot be discarded.

Your political past is being critiqued. Accept this.
You are responsible for misappropriating others
Be open yourself about the possibility of heterogeneity
Forget the dictum: Mathematics is all about objectivity.

(sits) After finishing this brief description of the history of reductionism, a question comes to the fore of my thinking: Am I not ignoring the fact that some aspects of my own culture harbour reductionism? Yes, perhaps because of my immersion into the dominant discourse of Western intellectual history, I might have forgotten some cultural landscape that also cultivates forms of reductionism. Or being born to a Brahmin family, I might un/knowingly wish to avoid the disclosure? Indeed, my intention is not to masquerade the embedding of reductionist ideology in the caste-based (and other forms of) hierarchy that, in its extreme form, uses a feudal-reductive worldview for maintaining the social system. This disempowering social system might have been a support for the 'hegemonic-globalist' image of the Western Modern Worldview that promotes elitism and exclusion in mathematics education via one-size-fits-all perspectives of curriculum design. Given this insight into the reductive-disempowering nature of local practice and the Western Modern Worldview, a number of inquiry questions are likely to arise here: Which aspects of globalisation are helpful for developing a socially responsible mathematics education in Nepal? In what ways can the competing views of *contextualism* and *globalism* be reconciled for developing an holistic vision of mathematics education? I have addressed these emergent questions in Section Six of my thesis. ***(curtain falls. the director requests the audiences to send their suggestions on possible conclusions of this episode. he also makes an announcement that the official conclusions will be performed in 10/15 minutes.)***

CURTAIN RISES

Act 7: Conclusions

NARRATOR: ***(bows and stands.)*** In this way, this episode has embodied my *acts* of exploring meanings of reductionism prevailing in the field of mathematics education in Nepal. I have come to know that the notion of reductionism as ideology prevents mathematics education from being an emergent and dynamic domain of inquiry. I have come to realise that reductionist methodology has an interest in endorsing a homogenous and singular form of mathematics, thereby promoting the narrowly conceived mathematics teaching as transmission and mathematics learning as rote memorising. Guided by the idea of logic as ordering reality, the notion of reductionism as logic does not seem to promote holistic thinking in conceiving an inclusive mathematics education.

(sits on one of the chairs) Looking at historical routes (and roots), I have come to realise that reductionism appears to have been the legacy of key schools of Greek civilisation, thereby contributing to the development of 'modernist mathematics' (i.e., symbolic, algorithmic, formal). Perhaps, during the heyday of European colonisation transportations of mathematics curricula from home to the colonies (e.g., India) and then to their neighbours (e.g., Nepal) contributed to the widespread hegemony of reductionism-inspired views of mathematics teaching, learning and assessing. I envisage that Nepali mathematics education facing such a widespread hegemony is ripe for transformation from reductionism to holism. With such a view in mind, my performative *Acts* in the next episode (i.e., Chapter 8) endeavours to take you through a journey of sharing different types of reductionism orienting mathematics education in Nepal. ***(greets the audience with Namaste. leaves the stage. curtain falls)***. ***People in the audience take a break for tea and coffee. In the midst of increasing noise, an announcement is heard:*** **The next episode will begin in half an hour.**

EPISODE II (OR CHAPTER 8): DELVING INTO KEY TYPES OF REDUCTIONISM

(the Director recapitulates the previous episode and makes an announcement that Episode II starts in three minutes.)

CURTAIN RISES

Act 1: Finally, The Monotonous Class Is Over!

TUTOR ***(sound effect: a classroom context, Pratap explaining about the method of algebraic factorisation to Grade Nine students. the volume of the sound is lowered. the adjoining poem is pasted on the flannel board as a poster. stands):***

Dear Pratap

It can be sometime in the first week of October, 2004. You request me to visit you class. "Well, that's a good idea, Pratap. When do you want me to visit your class," I say to you, hoping to gain insights into your situatedness as a teacher and department head. Despite my enthusiasm in reciprocal learning, your purpose of inviting me to your class sounds somewhat bewildering as you repeatedly mention that you are in a good private school of that area. "Do you know that

Observing The Class

Why do mathematics teachers resist change?
Why do they think they only subsist in certitude?
Why do they feel threatened from "recent" things?
Why do they celebrate uni-dimensionality of beings?

Why do they want to cover the content?
Why don't they focus on meanings instead?
Why do they want mathematics to be "pure"?
Why don't they use dialects of pure and impure?

Why do they privilege rote memorisation?
Why don't they invite a "barefoot" mathematician?
Why don't they incorporate cultural games?
Why don't they use patterns of local gems?

Why do they prescribe moment-to-moment?
Why do they say the Earth is flat, lines are straight?
Why do they privilege "closed" perfect figures?
Why do they always use "mind" to derive formulas?

Why do they follow linear pedagogical models?
Why are they so frightened by emergent wisdoms?
Why do they reduce complex visions of education?
Why do they divide the world to 'yes-no' thinking?

Why don't they come out of reductionist shelves?
Why don't they expand their own selves?
Why don't they think beyond the Euclidean plane?
Why don't they practise critical self-reflection?
Contd…

International Standard Secondary School has been maintaining a high pass rate in the SLC exam since 2002?," You seem to be so proud of the school, your department headship and your didactic teaching methods. On the contrary, you do not seem to engage in classroom discussion, nor do you go through reading materials. Your disengaging posture is often reflected in classroom discussions in which you speak a sentence or two as an uninformed naiveté. In the midst of my pondering, you appear again in my office so as to fix a date for my visit. Finally, I make a visit on an October Tuesday in 2004 with the pristine goal of engaging you in a critical discourse on your own pedagogical praxis.

Contd…

Why does the same pattern of desk-benches prevail?
Why do mathematics teachers always yell in the hall?
Why do they trap the students in their world?
Why do they claim that they know 'the' truth?

Why is teaching mathematics a way of subjugating?
Why is mathematics learning always conforming?
Who authorises teachers to teach this way?
Who encourages teachers to sort out the say?

Who suggests teachers to privilege the order?
Who encourages them to discard the disorder?
Why do they learn to be absolutely certain?
Why don't they unpack their uncertain terrain?

Why do teachers expect students to follow their ideas?
Why don't they question the invisible assumptions?
Why do they think that students are inferior?
Why don't they look upon their own interior?

Why do mathematics teachers derive formulae first?
Why do they ask students to copy it?
Why do they always verify students' answers?
Why do they use restrictive language games?

Why do they ask for a single correct answer?
Why do they prescribe an algorithmic structure?
Why do they translate a term into single meaning?
Why do they avoid informal problem solving?

(sound effect out)

As I enter the classroom, I see all students sitting quietly in eight rows of benches with approximately five students in each bench. You start the topic of mensuration with a problem like this: Find the total area of four walls if the floor's length and breadth are 14 and 12 feet respectively and the height of the room is 11 feet. Students solve the problem quietly and wait for you to announce the right answer. You announce that you will give them five more minutes in order for all students to finish off the task. Until now, your continuous command of 'keep quiet' appears to be followed by the class.

Dear Pratap! In the next episode, you invest an important slot of time in solving the problem. You explain each step and ask for students' confirmation whether or not they have understood. You appear to be pleased by the response of 'yes sir' or muted silence. And, you do not seem to be in the mood for hearing responses like these: 'No sir, I don't understand', 'I understand partially', 'I understand that particular… but cannot get the remaining'. Perhaps, it is their habituated and unconscious response to your frequent question: 'Do you understand?' Equally, I am not sure whether or not you are mindful of what you are asking. In the midst of contemplation, I look around the conceptual mesh of pedagogical reductionism as students anxiously await their teacher (you) to complete the solution of the problem.

Your demonstration of the solution to the problem on mensuration comes to a closure. All students are busy tallying their solution with your solution. Eventually, you command all students to raise hands if they have solved it correctly and got ten the right answer. I see around ten unraised hands. You must have noticed some of them because three are sitting in the first row. But to my surprise, you blatantly ignore the unraised hands as if you have already got enough numbers to prove your pedagogical efficiency. Who knows, you might be thinking that you are a successful teacher because you have got a majority of hands raised in your favour.

Dear Pratap! You make an announcement that you are going to derive formulae for finding areas of four walls, with the floor and without the floor. "The solution I demonstrated to you does not use a specific formula. If you know the formula, you can act and think like a mathematician. … The power of mathematical formula is unimaginable. And, this topic is very important for the final exam," you declare as if the formulas that you are going to derive can magically solve problems around us. As your reductionist lenses keep on making futile assertions, I begin to question my presence in this classroom. At some point, I feel that I need to speak against your ongoing assault on the potential imaginative power of these ninth graders. However, I tighten my mouth so as to abide by the ethics of being an outside observer.

The formula is derived, but there is no joy in this. Nor is there a sense of ownership of the newly derived formula. It appears to me that this is a dull moment that comes and goes unnoticed every day. By the end of your derivation, every student looks tired but relieved. You finish teaching with the declaration that the first exercise related to mensuration is the homework for students. "Finally, the monotonous class *is over," a whisper between two students, who are sitting next to me, through my left ear.* ***(sound effect: slow and soft drumbeat for about 45 seconds. curtain falls. the Director makes an announcement about the next Act)***

CURTAIN RISES

Act 2: Prologue

NARRATOR*: (stands)* 'Do not forget to chant hymns after reading the story' is a common request to the storyteller by listeners during Vedic rituals[47]. In such a situation the storyteller needs not only to be verbally skilled in storytelling but also in chanting hymns. In the process of constructing the composite story, *Finally The Monotonous Class Is Over*, my cultural past as a storyteller inspires me also to generate the poetic chanting, *Observing The Class*, so as to unpack ineffable aspects of experiencing reductionist mathematics pedagogy. Nevertheless, I am not prescribing here that you should first listen to the story and then follow the poetic chanting, rather I am trying to establish possible links between the multi-genre culture which has shaped my childhood and early adolescent years and the dialogic nature of knowing as an alternative to reductionist knowing widespread in the field of Nepali mathematics education. ***(sits)*** In this process of establishing links between 'cultural' and 'epistemological', I quickly realise that my role as a performative researcher can be articulated well via the "the being of possibilities" (Sartre in Greene, 1997, p. 191) so as to embody much-needed growth, expansion and transformation for cultivating meaningful alternatives to reductionism.

(stands and walks to the edge of the stage) Moving ahead with these perspectives, I realise that the ghosts of reductionism surround my textual neighbourhood, as the term 'types' embedded in the title represents the legacy of reductionism. So, how can I manage this paradox of using a reductionism-aligned term or concept and challenging the prevailing reductionism in the field of mathematics education? Indeed, I am not considering *my* types of reductionism as fixed and final; rather I

[47] In my experience as the son of a Hindu priest, stories of Swasthani and Satyanarayan are concluded with the chanting of devotional hymns.

treat them as contingent constructions. Similarly, my embracing of a non/essentialist[48] view of language can also help alter the reductionist language game so as to embrace a dialogic and poetic mode of representation (Granger, 2006). Thus, subscribing to storied and narrative genres, I am going to discuss key features of systemic, curricular, pedagogic and evaluative reductionisms together with their implications for mathematics education in Nepal ***(still standing. sound effect out. curtain falls. The narrator is seen walking to the backstage).***

CURTAIN RISES

Act 3: Systemic Reductionism

STORYTELLER ***(appears sad. a soft-music generated via a bamboo flute (Bansuri) serves as a sound effect. the sketch of Branchless Tree (Figure 4) is pasted on the wall behind him)***: ***(stands)*** *Is systemic reductionism not a significant problem for developing an inclusive and holistic mathematics education in Nepal? As hours pass by, I keep on raising this question with a feeling that I have not been able to clarify the notion of systemic reductionism. Also, I become doubtful about my reading methods as I could not spot any convincing definitions of systemic reductionism. However my feeling-embedded experience as a teacher and teacher educator keeps on insisting that I should not drop the theme of systemic reductionism from my emergent inquiry.* ***(becomes thoughtful)*** *Perhaps, I need to develop some corrective measures about my reading method: Am I following a reductive method of reading by excessively looking for literal meanings and bulleted points? Perhaps, a reductive method of reading is exclusively associated with finding definite ideas as if answers to my research problems and questions are buried in others' textual swampland.* ***(sound effect out. smiles slightly.)*** *Perhaps, I need to embrace a reflective-imaginative reading that possibly links the idea of literature with my experiences. Let me try this way.* ***(curtain falls.)***

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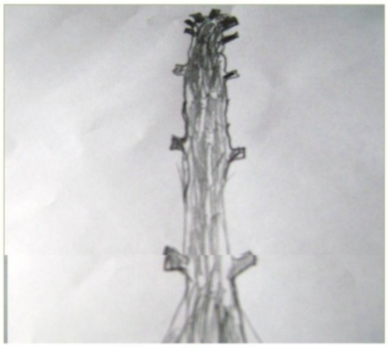
[48] The notion of non/essentialist view of language is about cultivating the interpretive nature of language via multiple genres and logics (Granger, 2006).

CURTAIN RISES

NARRATOR (***wears the formal Nepali dress. the poster of a branchless tree is seen on the wall***) : ***(sits)*** With the notion that systemic reductionism is a tendency to represent a system in terms of its lower level functionalities (Floyd, 2008), I have taken an experiential and metaphorical approach to explore key features of systemic reductionism, and its potential implications for mathematics education. To do so, I have used my experience of working as a teacher educator within the education system of Nepal together with the visual metaphor of a branchless tree (see the poster, Branchless Tree). Here, my notion of system is a set of interacting and interdependent structures that generate meanings performed by its actors (Semetsky, 2008). In this process, I am using three key features of a branchless tree[49] (i.e., shadowy-dark colour, approximately linear posture and impossibility of hosting birds' nest) so as to explore key features of systemic reductionism.



Branchless Tree

(*stands*) As I begin to explore the nature of reductionism via the metaphor of branchless tree, I interpret its shadowy-dark colour (as opposed to the green colour which is regarded as a signifier of liveliness and dynamism) as the signifier of lifelessness embedded in systemic reductionism. This interpretation of colour, however, is not my attempt to reinforce a colour-based hierarchy of people. Such a lifelessness feature of systemic reductionism embedded in the education system of Nepal appears to have oriented mathematics education to exclude the mathematics embedded in the cultural practices of Nepali people. In my mind the notion of culture

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[49] I have used this metaphor here as a result of my reading of some epics of ancient Vedic traditions, some of which use branchless tree as a metaphor for stagnation, powerlessness and uselessness. For instance, the epic, Mahabharata, uses the image of branchless tree so as to describe a powerless 'arrow' that was discharged by Kaurabas (Fitzgerald, 2004). Similarly, the seven act play, Clever Krishna, has used the image of branchless tree named 'Visakha' for being unable to offer any shade to Krishna when he feels pain as his sweetheart Radha does not listen to his plea (Gosvami, 2006).

is a set of activities (as opposed to the exclusive notion of *culture as thing*) performed by people so as to generate meanings (Baldwin, 2006). Here, I am sharing my experience as a student who encountered a reductionist nature of formal mathematics that does not incorporate mathematics arising from my students' cultural practices. I am speaking from the vantage point of a teacher who reduced mathematics to symbols, algorithms and answers as per the guidelines of the curriculum document. ***(speaks somewhat loudly.)*** I am talking from my experience as a teacher educator (or a tutor for mathematics education units) who has observed a number of mathematics classes- such as *Finally The Monotonous Class Is Over* - cultivating the same odd reductionist nature of mathematics. Does this mean that the lifelessness feature of systemic reductionism is not helpful for developing an holistic mathematics education?

(***sits***) Next, taking the metaphor of *systemic reductionism as a branchless tree*, I envisage that the linearity embedded in the branchless tree corresponds with the linearity of input-process-output embedded in systemic reductionism. Whilst formulating the preceding sentence, I am challenged by a set of questions: Is it necessary that input, process and output always form a linear model? Cannot they be used to represent holistic systemic models? My experience as a student in primary and secondary schools and universities in Nepal suggests that reducing the entire education system (and subsystem, such as a school education system, a higher education system) exclusively to input-process-output model gives rise to an epistemology of transmission and a deterministic view of human nature[50] (P. Watson, 2005). Am I saying that the notion of linearity is always unhelpful for me as a teacher and teacher educator? No, my perspective here is that extreme linearity is not helpful for visualising a nonlinear, holistic and multidimensional nature of mathematics education ***(drinks a cup of water)***.

[50] According to this perspective, human cognition and behaviours are results of causations. The extreme form of it implies that there is no such thing as human agency.

(stands)I see the branchless tree being the signifier of the non-dialogic posture embedded in systemic reductionism. Without having leafy and long branches, a branchless tree is not able to host doves, cuckoo-shrikes and sparrows. Which feature of systemic reductionism does this state of branchless tree indicate? Metaphorically, it seems to imply a non-interactive and non-dialogic nature of a system that does not encourage interaction between its constituents. Rather than overly indulging in a theoretical discussion, let me explore its potential impact on conceiving an holistic mathematics education in Nepal. Having systemic reductionism as an overarching directive, mathematics education in Nepal privileges a singular aspect of mathematics (that is, symbolic, abstract, algorithmic, pure), which is not inclusive of dialogic epistemologies and pedagogies. Can I claim here that reductive logics embedded in the education system are less likely to encourage mutual dialogues between different dimensions of the nature of mathematics? Can I say that a synergy between *pure* and *impure* mathematics is difficult to achieve through an education system that harbours reductionism as an orienting perspective? Can I say that I prefer an holistic, inclusive and dynamic education system as mentioned in the poster? ***(points to the poster, In My Dream)***

In my dream

I have a green garden as a metaphor
for an education system of vigour
for a liberation from captivity
for a huge shift from morbidity

I tell a story of flowers as an allegory
for flowers symbolise Nature's beauty
with which to harmonise our actions
for morphing artificiality to naturalness

I find a butterfly travelling around
shifting swiftly without a big sound
such a transformation I wish to see
in a humanistic system of inclusivity

I see different types of flora and fauna
Unity-in-diversity becomes a key idea
Farewell to taken-for-granted uniformity
A safe exit of the hegemony of singularity

(***sits***) To put it briefly, systemic reductionism generates monological epistemologies which are less likely to develop an inclusive and holistic mathematics education. Having a deep-rooted linearity (of input-process-output) as a major operational mode (Sharma, 2000), systemic reductionism embedded in Nepali education system is less likely to offer a space in which to conceive a multidimensional and dialogic nature of mathematics to facilitate my journey of conceiving an holistic and inclusive mathematics education. Before starting yet another journey of exploring features of curricular reductionism, I would like to share my poetic rendering of systemic reductionism. ***(stands. walks around the stage until a devotional music generated through a Sitar is played as the sound effect)***

First, I met you in my primary block
Instructing me to follow strictly the textbook
Situating me in a narrow learning course
You taught me to delimit mathematics
To the knowledge of numbers and symbols

Second, I met you in my high school
You were ruthless to the mathematics of people
You commanded me to believe in mathematics
From within pure symbols, algorithms and definitions
Rather than by looking at people's impure practices

Third, I met you in my teacher preparation course
You asked me to follow short-cut methods
'Confusing' --You blamed interactive pedagogies
'Non-mathematical'--You categorised my extended lesson plans
'Impure'--You labelled my project on mathematics of local Temples and Stupas

(greets by Namaste. sound effect is out. curtain falls)

CURTAIN RISES

Act 4: Curricular Reductionism

STORYTELLER: (***looks like an artist. shows the adjoining poster, Yes To Books And No To Village Life, to the audience and then it pastes on the flannel board next to his chair): (stands)*** *I have spent an hour or so conceiving a visualisation of curricular reductionism. Although I am not an artist, I try translating my imagination into a visual sketch that possibly helps me express it in a lively way. After several attempts, I find myself improving the quality of the visual sketch very slowly. As the sketch does not satisfy me after a number of attempts, a*

Yes To Books And No To Village Life

conventional academic in me teasingly asks: Aren't you spending these precious minutes in futile activity? ***(walks to the left corner of the stage)*** *Instead, might you have reached already the next page of your textual construction? Although I am mindful about my idiosyncrasy embedded in this sketch, the creative artist in me encourages me to continue this act of visual imagination. Whilst pencilling the sketch* ***(points to Poster : Yes To Books And No To Village Life)****, a part of my mind is busy travelling around my experiential world in which I encounter students being asked to leave their lifeworld outside their mathematics classrooms. I reminisce. I am nostalgic. I smile. I am sad. I take a fresh look at my sketch.* ***(appears confident)*** *Yes, it nearly represents my experience of the nature of mathematics embedded in the curriculum that guided my learning and teaching. (Journal entry, August 2008)* ***(curtain falls).***

CURTAIN RISES

NARRATOR*: (stands. coughs gently)* I would like to begin this section with a popular truism embedded in Eastern wisdom traditions: *If you want to touch a thing, expand it first* (Crowley, 2005). Guided by the notion of *knowing as mythmaking*, I am bringing the truism to this space to share my approach to cultivating meanings of curricular reductionism prevailing in the field of mathematics education in Nepal. Similarly, the sketch of my visual metaphor has hopefully revealed and crystallized the notion of curricular reductionism embedded in my experience. Given these perspectives, I am going to unpack key features of curriculum reductionism and their possible implications for mathematics education.

(***sits)*** My visual metaphor ***(points to the sketch of the poster,* Yes To Books And No To Village Life*)*** conveys a dichotomous message: *yes to books and no to culturally rich village life.* In my experience this is the main feature of curricular reductionism embedded in Nepali mathematics education. An implication of this feature is likely to privilege 'formal mathematics'[51] as the sole 'type' of mathematics whilst

[51] For me, the idea of formal mathematics is associated with the Formalist school of mathematics that promotes the view of mathematics as a manipulation of muted symbols.

designing the curriculum. In this situation, Nepali students are likely to see mathematics as a subject unrelated to their day-to-day lifeworlds, thereby losing interest in mathematics learning. As a result of this, they are unable to harness the important mathematical knowledge and skills which are essential for their present and future life.

Next, curricular reductionism is entrenched in the hegemonic metaphor of *curriculum as subject matter* (Schubert, 1986). Here, I have used a metaphorical approach to conceiving the notion of curriculum as a multifaceted field because metaphors give insight into different forms, facets and aspects of curriculum (Lakoff & Johnson, 1999). To my understanding, whilst privileging the image of *curriculum as subject matter* as a major referent for curriculum design, Nepali mathematics education is likely to generate two negative impacts for teaching and learning activities of mathematics: (i) teachers are oriented to promoting the reductionist perspective of teaching to the test, and (ii) creative approaches to teaching and learning mathematics are preyed on by the 'content coverage' pedagogy. However, I am not saying that 'content' should be avoided in the mathematics curriculum, rather I am resisting the one-size-fits-all approach embedded in the image of *curriculum as subject matter*.

(stands) In order to unpack yet another feature of curricular reductionism, I reflect upon the way in which the mathematics curriculum of my primary education prompted me to conceive *mathematics as a foreign subject*[52] because of unfriendly symbols and algorithms presented in my mathematics textbooks. The image of *mathematics as a foreign subject* is still hegemonic in Nepali classrooms as demonstrated by the pedagogy of the signature story of this chapter, *Finally*, *The Monotonous Class Is Over*. from a writerly point of view, this story mirrors how 'foreignness' patrols the boundary of mathematics classroom so as to maintain the purity and certainty of mathematics (Restivo & Bauchspies, 2006). Here the notion of purity refers to the symbolic, algorithmic and abstract nature of mathematics

[52] In my Master's project, I have discussed the image of mathematics as a foreign subject that I encountered in my primary education. I used the term 'foreign' for mathematics because it did not have stories, poems and play as in other subjects (Luitel, 2007).

whereas certainty is associated with the seeming infallibility and completeness of mathematical knowledge (Hersh, 1997). Based on my experiential warrant, I have come to realise that the image of *mathematics as foreign subject* reflects the tendency to separate mathematics from students' lifeworlds, a rendition of curricular reductionism prevailing in the field of mathematics education in Nepal.

(sits) To summarise, I have come to realise that curricular reductionism embedded in the image of *curriculum as subject matter* seems to restrict teachers from cultivating agentic curriculum images – *curriculum as currere, experience, an agenda for social reconstruction*[53] – that can be helpful for opening different aspects of knowing and knowledge traditions required for increasingly complex and hybrid Nepali worldviews. Next, curricular reductionism colonises the minds

My Curriculum

Like the rainbow,
My curriculum coheres multiple colours,
the colour of knowledge
arising from *inside* and *outside*
embedded in customs and traditions
of locals, neighbours and foreigners

Like the rainbow,
my curriculum offers an illuminating pathway
that each individual walks through
with deepened and widened experiences
from real to unreal
from obvious to mystical
from exoteric to esoteric
from without to within

Like the rainbow,
my curriculum creates a bridge
between *here* and *there*
between near and far
between self and other
between actual and imagined
between expressible and ineffable

Like the rainbow,
my curriculum represents
unity-in-diversity
through a montage
that coalesces images
of dances and footprints
of formulae and symbols
of targeted arrows
of meaningful protests
of mirrors

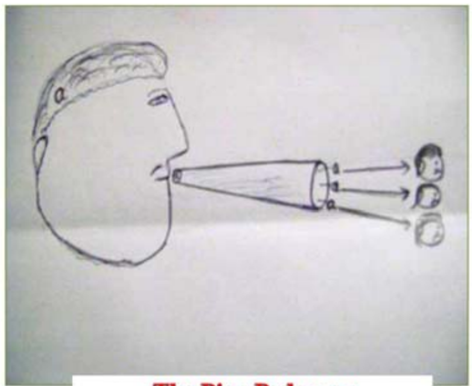
[53] According to Shubert, curriculum can be conceived via metaphorical images in a better way than via literal approaches. The image of *curriculum as currere* promotes personal meaning making with the help of autobiographical genre whereas *curriculum as experience* serves an interest in consensual meaning making. The image of *curriculum as an agenda for social reconstruction* promotes a transformative function of education by placing emphasis on social justice, emancipation and agentic pedagogies.

and hearts of teachers and students, thereby making them oblivious to creative possibilities of the blending of sometimes contrary images of curriculum. Therefore, I argue that curricular reductionism prevailing in the field of Nepali mathematics education hardly incorporates different forms of mathematics arising from people's practices so as to make mathematics learning meaningful, agentive and holistic as I have articulated in the poster, My Curriculum (***points to the poster, My Curriculum***). Section Five of this thesis explores further the reductionist influence in designing and implementing the school mathematics curriculum, thereby exploring some holistic visions of curriculum development. ***(curtain falls. the stage-switch is still on.)***

CURTAIN RISES

Act 5: Pedagogic Reductionism

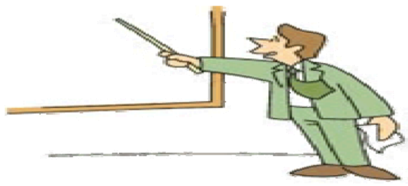
STORYTELLER ***(looks like a meditating person.)***: *(**sits**) Now, I am running out of letters, words and sentences. My mind (in the body) does not release a single word. My fingers are motionless, poised over the keyboard. An astonishing silence surrounds the room. The feeling of no-thing-ness grows further as if the remaining faint marks of letters, words and sentences in me are going to disappear. Some sections of my body quickly remind me of my notes as a potential basis for recovering my lost 'words'. (**speaks gently**) I go through them with the hope that my letters and words will be restored. Although the page appears full of words and sentences, I cannot recognise and utter them properly. Even if I see them initially, they quickly fade out one-after-the-other in a while. Even if I utter them, my utterance is almost inaudible. There is no sense of possession nor is there a sense of self. The body is not felt nor is the mind grasped. (**stands**) For a moment, there is no 'I' which I relate to myself and the world. Unconsciously though, I wait to recover myself from this massive writerly block. (From my journal entry, July 2008)* ***(curtain falls.)***



The Pipe Pedagogy

CURTAIN RISES

NARRATOR: ***(pastes the poster: The Pipe Pedagogy on the flannel board next to his chair. sits)*** In order to elaborate the notion of pedagogic reductionism, I would like to introduce two important pedagogic concepts: *logos* and *mythos*. The term, *logos,* is the realm of orderly transfer of knowledge as if there is an ideal pipeline ***(points to the sketch: The Pipe Pedagogy)*** between teacher and students whereas *mythos* is the domain of constructive connections between culture, self and mathematics (Leonard & Willis, 2008). The maximum portion of my experience as a mathematics student is constitutive of logos-oriented pedagogies that busy teachers in transmitting mathematical definitions, pre-set algorithms and theorems rather than generating contextual understandings of mathematical knowledge. Retrospectively speaking, my role in such a classroom was to receive exactly what came out of the teacher's mouth. Furthermore, my experiences as a teacher and teacher educator resemble the same feature of mathematics pedagogy in which 'emergent' and engaging discourses (Kuhn, 2008; Walshaw & Anthony, 2008) are almost prohibited in the mathematics classes. Considering logos-oriented pedagogies as the characteristic avatar of pedagogic reductionism, I am going to unpack their features and implication for mathematics education in Nepal***. (Narrator stands and moves toward the table. grabs one of the rolled papers. unrolls and pastes it on the flannel board. the audience curiously glances at the poster, Poetic Renderings of Pedagogy-1, as Narrator sits on the chair.)***

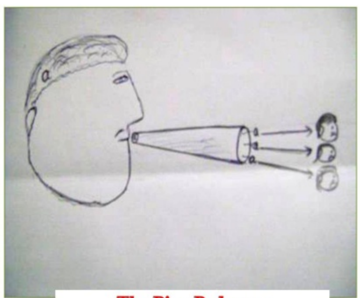


Poetic Renderings of Pedagogy-1

A transmissionist teacher speaks:
I am a mathematics teacher
My job is a transmitter
I choose symbols, algorithms and words
So as to pack and send accurate meanings
Students should be able to unpack my parcel properly
If they don't, it's not my responsibility

(***gentle coughs. sits)*** Reminiscing on mathematics classes that I have observed whilst working as a teacher educator (as demonstrated in the signature story of this Episode), I realise that logos-oriented pedagogies became an ideal tool for sustaining the exclusive transmissionism in mathematics education. In such classrooms I have hardly heard the language of lifeworlds, rather I have encountered a set of terms endorsing reductionist language (Granger, 2006), as embedded in the explanation of the Transmissionist Teacher ***(points to the poster: Poetic Renderings of Pedagogy-1)***. Here, the language of lifeworlds refers to the language of empathy and relationships between culture and nature, between people and culture, and between knowledge and world, whereas a reductionist language refers to a linguistic context where a set of limited terms with fixed and reductive meanings patrols the border of mathematics pedagogy. In my experience, the terms that are used most in mathematics classrooms are *understand*, *problem* and *solution*. For me, the meaning of *understand* is reduced to following the teacher's performance whereas the term, *problem*, is used to represent an algorithmic *sum*. The buzzword of *solution* does not encourage students to make a bridge between bookish mathematics knowledge and the knowledge arising from the world in which they live. Instead, finding the solution of a problem is restricted to the re-production of a prescribed algorithm. In saying so, I am not totally dismissive of (logos-centric) pedagogic reductionism, rather I am unpacking its hegemony as a means for envisioning inclusive pedagogical alternatives.

(stands) During my primary and secondary levels of education, I developed the perspective that teaching, learning and assessment are always situated along a straight line. The idea of the linear positioning of teaching, learning and assessment was further strengthened during my university education in Nepal (Luitel & Taylor, 2006). I believe that the hegemony of such a linear pedagogic model is not very much supportive for teachers to embrace self-reflection, critical contemplation and creative visions of their pedagogies (arising from sociocultural and political renderings (Walshaw, 2004b)). Nevertheless, I do not mean to say that *all* mathematics teachers who embrace a linear pedagogic model do not subscribe to reflectivity and criticality in their thinking and actions. Perhaps, such a straight-line model of pedagogy is accomplished by transmissionist pedagogy, a visual metaphor of which is presented as the 'pipe pedagogy' ***(points to the poster: The Pipe Pedagogy)***. Why do I choose to represent the transmissionist arising from pedagogic reductionism as the 'pipe pedagogy'? For me, transmissionist pedagogies are guided by the assumption that knowledge is banked securely in words and



The Pipe Pedagogy

sentences (Freire, 1993). An extreme form of this assumption is likely to perceive the linguistic tools (e.g., letters, words, sounds) as the pipe which seemingly saves knowledge from being diluted and distorted. I am not saying that it is totally wrong to use the metaphor of pipe pedagogy, rather my contention is that the uncritical posture embedded in it does not help search for other creative pedagogical approaches which possibly help mathematics to be an inclusive learning area.

(sits) Viewed from the perspective of culture[54], I come to realise that logos-oriented pedagogies are likely to reproduce the culture of fixity and order. Cannot such a culture be appropriate for reproducing the nature of *mathematics as a body of pure knowledge* (see Section One)? I say yes to this question because the uni-dimensionality (and perhaps reductionism) entrenched in the nature of *mathematics as a body of pure knowledge* loses its essence, if we are to place this nature of mathematics in the culture of ongoing changes and dynamism. I argue that the culture of order and fixity associated with logos-centric mathematics pedagogy is likely to be guided by three assumptions, that (i) the world of mathematics is more *logical* than the world outside of it; (ii) the knowledge of mathematics is *unchanging*; and (iii) mathematics loses its essence if not used as a *rigorous* algorithm. It is likely that my story character, Pratap, says that being 'logical' is about restricting students from delving outside of pure (i.e., symbolic, abstract, formal, algorithmic) mathematics. Such a logicality can be an important instrument for giving the impression that mathematics is an unchanging body of knowledge. In a similar vein, the idea of *rigorous* algorithm often becomes a buzzword for preventing students from learning forms of mathematics that are outside of pure mathematics.

[54] The perspective of culture is about looking at the meaning, pattern of communication and underlying assumptions (Baldwin, 2005)

(stands. look at someone in the audience) To summarise, I envisage that the logos-centric feature of pedagogical reductionism does not help fully realise a holistic and inclusive mathematics education in four possible ways. Primarily, logos-centric pedagogies exclude the contextual and emergent nature of knowledge systems and knowing processes because of the fear that they may disrupt the order maintained by logos-centric pedagogies. Here, my notion of order indicates the imposed structure of mathematical knowledge over the emerging nature of contextual knowledge systems. Next, the transmissionist pedagogy embedded in pedagogic reductionism is less likely to encourage teachers to employ agentic pedagogies because the exclusive form of transmissionist pedagogies serves the interest in control. Can an exclusively control-inspiring pedagogy help instil an inclusive and holistic mathematics education? I argue here that the logos-centric feature of pedagogical reductionism is less likely to recognise multidimensional nature of *mathematics as an im/pure knowledge system*, which can be a referent for an inclusive and holistic mathematics education. In my vision, pedagogical perspectives that help conceive different images of teacher can help transform the extant pedagogical reductionism, as I have mentioned in the poster, Poetic Renderings of Pedagogy-2. (***points to the poster***) ***(curtain falls but the stage-switch is on)***

> Poetic Renderings of Pedagogy-2
>
> A critical teacher speaks:
> Transmissionist, what type of teacher are you?
> You have an utterly narrow world view
> You don't pay attention to student participation?
> Students seem to be suppressed in your classroom
> Are you a teacher or a tyrant ruler?
> Perhaps, I need to stop by for a makeover.
>
> A postmodern teacher speaks:
> Deconstruct the meaning of teacher
> Remember, students can also teach and learn better
> Change the semiotics of the conventional classroom
> Alter the hitherto language game of transmissionism
> Privilege local, subjective and impure
> Say goodbye to global, objective and pure
>
> A holistic teacher speaks:
> I am a mathematics teacher
> My role is a facilitative synthesizer
> I connect local lending with multinational banking
> I forge alliance between algebra and farming
> I help students see a bigger picture
> I hope to be more than a critic of power
> I go beyond romantic deconstruction
> I plan to transcend the filthy transmissionism

CURTAIN RISES

Act 6: Evaluative Reductionism

STORYTELLER ***(dressed as an army man, the Storyteller enters the stage with the poster: Uni-Dimensional Evaluation which he pastes on the flannel board next to his chair. sits):*** *"Did you forget the measurement scale?", the commander asks loudly. "You look like a pathetic little fellow. Oh my goodness you are in my infantry!" I am really frightened because I have lost the measurement scale which I have been trained to use. The troop is busy 'doing' the task of measuring length and breadth of different parts of the mountain. Each of them has specific sections to measure. Most of the junior officers appear anxious because of variations occurring between the idealised mountain and the actual mountain. The pre- designed measurement scale does not seem to fit well as per the local need. One of the junior officers reminds them that doing this measurement is a matter of following the protocol, rules and order, otherwise there would be a clash between the predesigned plan and the implementation of it. Other junior officers are not sure about their main preference: either adapting the measurement scale according to the needs of the field or following the command of their seniors. In the meantime, one of the aspiring lieutenants explains to me: "Do you know anything about the infantry of scientific evaluation? We are that kind of troop. We measure what we are required to measure. We measure what objectives suggest us to measure. We measure what our commander commands us to measure." After I convince myself that it is not the infantry I can work with, I begin to walk around the mountain so as to take an emergent and interactive approach to understanding it. When I arrive somewhere in the middle of the mountain, I feel that something is chasing me up. The roaring sound causes me to run faster than ever before. I sweat. I am tired. My feet do not move. I am almost fixed. I wake up to my alarm which goes off at 5 am. What a good and bad dream?* ***(curtain falls as the storyteller exits backstage)***

Uni-Dimensional Evaluation

CURTAIN RISES

NARRATOR *(the poster, Uni-Dimensional Evaluation, is seen next to his chair. sits)*: Arriving at this stage, I am extending the story, *Finally, The Monotonous Class Is Over*, so as to unpack contextual meanings of evaluative reductionism. In this process, I am using the role of shaman who lets others enter their soul into her/his body and then speaks on behalf of that person. The metaphor of shaman gives me an epistemic means for unleashing others' stories from the interiority of my body and mind (Muncey, 2005). Constructed on the basis of my experience of working with a number of in-service teachers, the following letter explains the way in which evaluative reductionism is likely to occur in a Nepali school ***(curtain falls. Narrator exits temporarily)***.

CURTAIN RISES

PRATAP*: It is the second quarter of the year 2001. I have recently completed my undergraduate studies in mathematics from the Faculty of Science, University of Nepal[55]. I need to search for a job so as to sustain me while I pursue further studies in mathematics education. Life in Kathmandu is getting difficult day-by-day as many people from other parts of Nepal are sheltering here due to ongoing political conflict. As a graduate of mathematics, my only choice is to opt for the teaching profession because I have not seen any direct uses of mathematics from a career perspective. Unsurprisingly, I hold the view that teaching of mathematics is very simple and straightforward delivery of course content. I can be a good teacher because I know more 'mathematics' than the mathematics included in the school syllabus.*

*(**sits**) A month after I started the job search, I find myself in the Principal's Office of International Standard Secondary School, Kathmandu. "Being a private school, our main goal is to demonstrate a 100% first class success result in the school leaving certificate (SLC) examination. Otherwise, no one will send their children in my school", Mr. Cutback says in a dominating manner. "Your responsibility is grade nine and ten, especially their preparation for the SLC examination. Let me tell you*

[55] A pseudonym of a Nepali university.

one thing: I dismissed the previous mathematics teacher because of his inability to help us achieve the goal." I regard this as the orientation to my job. As an inexperienced teacher, I have a very critical time ahead. Perhaps, I have to come up with some magic-like strategies that can sustain my job. In the meantime, I am also planning to continue my postgraduate studies as a morning shift student? Am I daydreaming here, working as a fulltime teacher and undertaking postgraduate studies in mathematics?

(stands and walks to the right wall of the stage) *The year 2001 comes to an end. However, there are still three more months for a new academic year to start at the school. By now, I have developed some strategies to translate Mr. Cutback's dream into reality. I have collected all the old test questions and plan my teaching according to the SLC test question patterns. What else can I do given my limited understanding of pedagogy? My emphasis shifts from teaching for understanding (which I knew from my algebra professor in my undergraduate studies) to teaching for the SLC test. My mantra of teaching is "this is very important for your final exam!" Does this mean that I am not a creative teacher? Perhaps, combinations of my own perception of mathematics as an unchanging body of knowledge, the meaning of success conceived by the principal and the notion of student assessment embedded in the SLC exam situates me in such an awkward position where I am reducing myself to a performer of limited instrumental actions. Retrospectively speaking, teaching for the SLC test is an instrumental action (Grundy, 1987) because it reduces different aspects of teaching to technical procedures. Now, I wish there is a magic wand to liberate me from performing such actions.*

(sits. looks at his watch.) *As the academic year progresses, Mr. Cutback appears to have been satisfied by my performance. As the Head of the Mathematics Department, I circulate Mr. Cutback's orders to all mathematics teachers to simulate the pattern of SLC test papers in their classes. You may be interested to know about the nature of the SLC test. Most of the test items are meant to assess their ability to recall definitions, specified algorithmic steps and formulae. Perhaps, a very small percentage of those test questions address forms of "application" of their memorised knowledge. Nevertheless, the application-oriented questions are largely about applying mathematical formula for solving algorithmic problems rather than solving the problems arising from students' lifeworlds.* **(stands)** *Students' answers are* *assessed as per their exactness in relation to the prescribed algorithmic procedure that leads to the predetermined correct answer. In this way, I reduce my earlier meaning of conceptual understanding as an ability to see the relationship between axioms, definitions and algorithms to rote memorisation of axioms, definitions and prescribed algorithms. Numerical grades 'sans' explanation of their interpretation becomes the hallmark of the evaluation reporting of student learning. I become part of this cycle, repeated until the first quarter of 2005, when I left the school*. ***(Pratap exits as curtain falls)***

CURTAIN RISES

NARRATOR*: (emerges from backstage. stands)* Performing the acts of writer and reader, I generate a definition of evaluative reductionism as a tendency to privilege a 'value exchange' view of evaluation over the 'value judgement' view of evaluation (Wrigley, 2004). Here, a 'value exchange' view of evaluation refers to an approach that regards student assessment as an act of exchanging their performance and achievement with numbers, whereas the idea of value judgement is more inclusive of multiple indicators so as to account for multiple intelligences arising in the process of learning. Given this definition of evaluative reductionism, I am going to explore its key features as an insider of mathematics education in Nepal.

Embedded in my definition of evaluative reductionism and Pratap's performance is a feature of exclusive quantification of student performances. Closed-door written tests are the sole basis for quantifying students' performances in Nepali mathematics education. Such a two-level approach to evaluative reductionism might have been guided by a number of constituents embedded in the Western Modern Worldview that acts within Nepali mathematics education. Primarily, the Platonic myth of numbers as a pure and stable representation of reality appears to have (mis)guided the notion of student assessment as a way of reducing student performance to numbers. Similarly, the Formalist myth of mathematics, exclusively a body of algorithmic games of lifeless symbols, may have endorsed closed-door written tests as the only means for assessing demonstrations of students' abilities to play such algorithmic games (Sriraman, 2007).

(sits) Thus, such an evaluative reductionism is likely to promote a narrow view of intelligence as an ability to rote memorise definitions, theorems and algorithmic patterns and then to apply these to solve a large number of algorithmic-abstract problems that are less likely to link directly with the lifeworld of students (Sternberg, 2007). In such a situation, intelligences arising from cultural practices of students are unaccounted for, thereby giving the message that to learn mathematics perfectly one has to forget contextualised knowledge and knowing. ***(walks backward)*** Does the promotion of decontextualised forms of intelligence in student assessment not strengthen further the hegemony of singular view of mathematics as infallible knowledge? Can such a view not restrict learners from making creative use of mathematics in their present and future lives?

(sits)Another feature of evaluative reductionism embedded in Nepali mathematics education is associated with the treatment of assessment-related activities exclusively as an add-on activity rather than a set of activities integrated in the process of learning. Perhaps, such a reductive practice of assessment reflects the spirit of positivism which promotes the view of knowing as decontextualised knowledge claims. More so, a positivist perspective seems to promote the view that to have an ‘objective’ assessment of student learning performance one has to make sure that students are separated from learning contexts (Eisner, 2005a, 2005b). Whose interests are being served by such an add-on notion of assessment practices? ***(sits)*** I argue here that this approach to assessment is not in the best interest of mathematics education that strives to inculcate contextual, cultural, emergent and meaningful understandings of mathematics in students.

From my own experience as a teacher and teacher educator, the add-on feature of evaluative reductionism often turns students into fatalists as a result of placing the task of assessment apart from the process of learning. Speaking from a retrospective warrant as a high school student, I remember myself and my classmates using some ‘magic tricks’ for guessing important questions for the end-of-year tests. I also remember us playing ‘guessing games’ (perhaps, inspired by numerology) to find out questions for the test. ***(appears thoughtful)*** Which aspect of this feature is responsible for generating fatalism? Whilst raising this question, I am not implying that the add-on feature of evaluative reductionism is solely responsible for the fatalistic attitude of Nepali students, instead my view is that such a feature bolsters fatalism as a result of: (i) the exclusion of students from planning and designing assessment related activities, and (ii) depicting assessment as a tool for segregating learners as capable and incapable in terms of a narrowly conceived notion of knowledge and knowing.

(stands) Thus, I have come to realise that under the premise of evaluative reductionism the holistic notion of *evaluation as a portrayal of student performances* is taken away by the uni-dimensional notion of *evaluation as the measurement of student performance*. Perhaps, such a uni-dimensionality has arisen from an excessive emphasis on the 'control function' of student assessment. I envisage that the control function of student assessment is a tendency to privilege a particular type of assessment method, thereby accounting for very limited aspects of knowledge and skills developed by students during their learning journey. Do you think that I am always fond of generating critical comments? Indeed, I have visions for addressing evaluative reductionism, as I have presented in the poster, Evaluate. (***points to the poster, Evaluate***)

Evaluate

If you want to measure
take on board horizontal and vertical
consider length and breadth
pay attention to obliques and straights
account for growth and decay
behold patterns and no-patterns

If you want to assess
look for several parameters
imagine a holographic dimensionality
choose a language of inclusivity
incorporate a sense of place and temporality
highlight the greatness of positive outcomes
avoid the proliferation of exclusiveness

If you want to diagnose
look for 'both sides' of the problem
leave away the language of blaming
remember, quantity alone may not tell you how
a deepening eye may help you through

If you want to judge
don't always remain an outsider
don't put you 'up' there forever
don't exercise hegemonic control
don't privilege singularity
don't be loyal to uni-dimensionality
see 'them' through their lives
view from within and outside
look for effective and affective

(sits) In this way, I argue that different forms of reductionism provide a safe haven to the elitist mathematics education of Nepal. Systemic reductionism promotes a stable, linear and non-discursive vision of mathematics education whereas curricular reductionism prevents the mathematics curriculum from being inclusive of different forms of mathematics arising from students' lifeworlds. Subsequently, the hegemony of logos-oriented pedagogies reduces teaching and learning activities to the transmission of knowledge by teachers and passive reception by students. I believe that such a pedagogic reductionism has become a means for legitimating the conventional view of mathematics as an ‘unchanging subject’ whilst un/wittingly disapproving of the emergent knowledge of students’ lifeworlds. Finally, evaluative reductionism is likely to privilege the notion of intelligence as an ability to recall mathematical knowledge, thereby suppressing other forms of intelligence. ***(stands and raises the index finger)*** I argue that such a notion of intelligence is not helpful for conceiving a multidimensional nature of mathematics, a possible referent for inclusive and holistic mathematics teaching, learning and assessing. ***(curtain falls. the Director makes an announcement that the performance ends for today. the audience disperses for tea and some bites.)***

Recapitulating the Present, Mapping the Futures

With the key aim of exploring meanings and types of reductionism, thereby envisioning an holistic mathematics education, my inquiry in the first Episode (i.e., Chapter 7) of this section identifies different ways of conceiving reductionism, such as reductionism as ideology, reductionism as methodology and reductionism as logic. In this process, I have developed the view that ideology as reductionism is constitutive of a victim-blaming perspective which does not help teachers and curriculum experts to be critical of disempowering thinking and actions embedded in their personal and professional lifeworlds. More so, the section reports that reductionism as methodology can be a stumbling block for realising a much needed multi-paradigmatic (and holistic) epistemic and pedagogic visions for an inclusive mathematics education. In a similar vein, I have further strengthened my heartfelt view that reductionism as logic un/wittingly prevents inclusionary thinking (logics) from being included in the curricular and pedagogic frameworks of mathematics education.

Drawing from my experience as a teacher educator (i.e., tutor/lecturer of an in-service teacher education program at the University of Himalaya), the second Episode (i.e., Chapter 8) identifies four key types of reductionism, such as systemic, curricular, pedagogic and evaluative. In my narrative exploration systemic reductionism promotes a pre-designed linear view of education system which does not help account for emergent synergies between structural (global, overarching) and local (cultural, communal, personal) aspects of the system, thereby restricting mathematics education within the narrow, input-process-output framework. Whereas curricular reductionism operates through the narrow image of *curriculum as subject matter*, pedagogic and evaluative reductionisms give rise to transmissionist didactic teaching methods and assessment approaches that are not inclusive of students' various forms of intelligences. With the help of poetic texts juxtaposed against prosaic texts, Section Three presents my visions of holistic education system, curriculum, pedagogy and assessment as a way to pacify the ruthless reductionism that otherwise prevents mathematics education from being inclusive of sometimes antagonistic views, ideas and perspectives.

Similar to Sections One and Two, Section Three has given rise to a number of issues linking to the previous and upcoming sections of the thesis. My brief discussion of *old* logics (propositional, deductive and analytical), under the topic of reductionism as logic, gives rise to the issue of their potential implications for mathematics pedagogy. Thus, Section Four will investigate the nature of propositional, deductive and analytical logics in relation to my experience as a mathematics teacher and teacher educator, thereby exploring possible *new* logics which can help construct an inclusive pedagogical space, a means for cultivating multiple knowledge systems attributed to different forms (e.g., pure and impure) of mathematics. As I have explored aspects of the disempowering hegemony of curricular reductionism through the image of *curriculum as subject matter*, it is natural for teachers, teacher educators and curriculum workers to expect from me a vision that helps overcome the hegemony of reductionism. Given the overarching influence of curriculum as a perspective, Section Five is dedicated to investigating further the extent to which the reductionist image of *mathematics curriculum as subject matter* influences the process of designing and implementing the curriculum, thereby offering a transformative curriculum vision for an inclusive mathematics education in Nepal. More so, Section Six refers to the phenomenon of reductionism being prevalent in the mathematics teacher education of Nepal.

SECTION FOUR: 'OLD' AND 'NEW' LOGICS: CONSTRUCTING AN INCLUSIVE AND TRANSFORMATIVE VISION OF MATHEMATICS PEDAGOGY

Orientation

Gradually, a humanlike image guides me toward a thick rainforest wherefrom I can barely see the sun. Fearful of beastly animals, I follow the image through a narrow track, probably leading to an open and wide space. In the beginning, hours of walk does not take me any further than some half a kilometre away from the point of departure. The humanlike image indicates that there might be a wide path ahead, but s/he does not seem to be certain about his/her claims. In the meantime, a looming shadow follows me. I walk faster than ever before.

(Dream Diary #1)

In this section, the theme of my inquiry is the nature of logics that orient pedagogies of culturally decontextualised mathematics education in Nepal, the key research problem giving rise to a number of research questions as a basis for constructing sections of this thesis, and that I described in Section Zero via my autobiographical impulses as a student, mathematics teacher and teacher educator. In Section One, I have used different forms of dialectical logic to articulate a multidimensional nature of mathematics as an im/pure knowledge system. In the process of elaborating different forms of dialectics and their use in articulating the nature of *mathematics as an im/pure knowledge system*, I felt the urgency to investigate the disempowering nature of conventional logics (i.e., logic of '*A or B',* oppositional logic, binary logic, eliminative logic, reductionist logic, dualistic logic) that otherwise ignore the empowering possibility of dialectical and other inclusive logics. In Section Two of this thesis, I realised how it is significant to inquire into the nature and feature of logics that orient mathematics pedagogical and curricular practices, and that give rise to many unhelpful dualisms in mathematics education in Nepal. More so, whilst articulating the notion of reductionism as logic in Section Three, it occurred to me that a detailed exploration of conventional *old* and additional *new* logics can offer a new insight into an inclusive logical framework helpful for conceiving a transformative vision of mathematics education. With such realisations of further inquiry into meanings and key features of propositional, deductive and analytical logics, I have formulated three initial research questions to facilitate my inquiry in this section: *In what ways do these* old *logics orient mathematics education in Nepal? To what extent are these logics unhelpful for constructing an inclusive and transformative vision of mathematics education in Nepal? In what ways can mathematics education in Nepal embrace a multi-logics perspective for developing an inclusive mathematics education?*

Shifting away from the exclusionary notion of logic as an instrument for categorising, ordering and legitimating certain forms (linear, assertive, deductive, dichotomised, non-allegorical, symbolic-tautological) of human reasoning (Chakraborti, 2006) towards an inclusive notion of logic as a means for accounting for and representations of diverse profiles embedded in human consciousness (Rorty, 1988), I set out in this section to explore various features of *old* and *new* logics as a means for envisioning an inclusive mathematics pedagogy. Here, my notion of 'diverse profiles' depicts different aspects (e.g., personal, social, cultural, empathic, emotional, literal, non-literal, objective, subjective, conceptual, perceptual) of consciousness embedded in an eternal territory of body, mind, heart and soul (Semetsky, 2008).

Given this brief notion of logic, I set out four objectives to facilitate my inquiry in this section. First, I plan to explore meanings and features of propositional, deductive and analytical logics. Second, I aim to elaborate possible implications of these old logics for mathematics education in Nepal. My third objective is to explore features of additional *new* logics (metaphorical, dialectical, poetic and narrative). Last but not least, I intend to identify implications of new logics for an inclusive mathematics education in Nepal. More so, the section has been constructed primarily via the epistemic technique of narrative imagination, an approach to generate context dependant knowledge via narratives of the researcher (see Section Zero).

The section comprises two chapters. The first chapter (i.e., Chapter 9: Radicalising Mathematics Education, but with *Old* Logics) of this section begins with a composite story constructed on the basis of my experience of teaching *Mathematics Education,* a unit designed for students studying a masters degree course at the University of

Himalaya. In the process of writing this signature story, I have constructed an 'aside story' based on my experience as a mathematics teacher in a private school in Kathmandu Valley in 1994 (Kenyon & Randall, 1997). Considering these stories as a basis for exemplifying the meanings of key conventional logics (i.e., propositional, deductive, analytical), I explore disempowering features of these logics via my experience as a mathematics teacher and teacher educator. In the second chapter (i.e., Chapter 10: Journeying with *New* Logics: Creating Transformative and Inclusive Pedagogies), by constructing a story on the basis of an informal discussion with my students who are critical of my heretical[56] views of the nature of mathematics, I generate reflective-interpretive texts embedding retrospective and prospective meanings, thereby exemplifying features and implications of metaphoric, poetic, narrative and dialectical logics. Throughout the chapter, I have used different forms of transgressive texts (Guba & Lincoln, 2005) – dream diary and images -- so as to capture the multifaceted nature of inquiry as narrative imagination. The dream diary represents an epilogue-imagery of my inquiry whereas the boxed poems depict the aesthetic dimension of my imagination (Harrison, 2002). Needless to say, juxtapositions of images help generate visual metaphors, thereby opening a vista for thinking about options for representing knowledge claims (Taylor, Luitel, Désautels, & Tobin, 2007).

[56] The idea of heretic views of mathematics emanate from a host of philosophical ideas which challenge the Platonist and Formalist view of mathematics. These views include mathematics as contingent knowledge system, mathematics as activity, and mathematics as an impure knowledge system.

CHAPTER 9: RADICALISING MATHEMATICS EDUCATION, BUT WITH OLD LOGICS

Farewell to Euclid and Pythagoras: Mathematics Is Not A Universal Knowledge System!

It can be any Wednesday in the month of February 2006. Probably it is my second class for the recently launched program in mathematics teacher education. I grab one of the recently purchased laptops and LCD projectors, and head to the classroom so as to make sure that everything is going to be OK technologically. One of our office assistants follows me to the class and helps set up my PowerPoint presentation. "Ramesh-ji, is our generator in good condition?" I want to make sure that a sudden and frequent blackout does not hamper my class. "Thanks sir for reminding me of this. I have to make sure about it. I have been very busy dealing with our director's personal matters," Ramesh speaks with

> Aside Story: Celebrating dogmatism and purity of mathematics
>
> As I construct the signature story by depicting a snippet of my recent pedagogical practice, I begin to visualise a series of mathematics classes that I taught in 1994. My role as a mathematics teacher reels in front of me coalescing the minutiae of activities that took place in primary school grades in Kathmandu. These episodes relentlessly push my writerly self to carve them out in this window.
>
> Episode I
>
> It can be any day in the month of February, 1994. I am heading to the room of grade five. A cloudy winter poses a big threat for me and my students to keep ourselves warm in one of the rooms of the one-year old tin-roofed temporary shed. We are setting out to begin a new topic in algebra, that is, multiplication of binomial expression by another binomial expression. I probably start with a problem from the exercise on algebraic multiplication of their textbook probably brought out by an Anglo-Indian publishing house located in New Delhi. My usual ritual starts with solving one exemplar problem and asking them to practice a number of similar problems. "You should not do this. If you continue to do this, you will fail in the exam," I say showing one of their friends' mistakes in reproducing the algorithm that I commanded them to follow. They exclaim, bow down their heads and start correcting their grave mistake. It is a mistake in writing an 'is equal to' sign correctly. I have to orient my students to write the algorithm correctly because I have heard recently from an examiner for the answer sheets of SLC (a year 10 leaving certificate) examination that he failed nearly fifteen students for not using standard mathematical symbols prescribed by textbooks which he still thinks is the best available book in school mathematics.

a melancholic face and a frustrated voice. "Why does this director use the office assistants for his personal benefit? Perhaps, it is his old feudal legacy that is hampering our activities here," I make use of my rhetoric to fire at the director in his absence. Soon Ramesh disappears from the scene as students begin to enter the room.

As the minute hand of the 'wall watch' approaches 'four thirty', I get set to start my presentation. "Can we wait for five minutes sir? I got an 'sms' that two of our friends are in the middle of a long jam in Koteshwor." Hari's solidarity-filled request puts me on a hold for a while. Rather than staying idle, I begin to share my plan about today's two-hour class. "First, I will make a presentation on the nature of mathematics focusing mainly on the writings of Reuben Hersh and Paul Ernest[57]*, but I will also use others' ideas if necessary. Probably my presentation won't take longer than 45 minutes. The remaining an hour or so will be dedicated for a cooperative group work on themes arising from my presentation," I say looking at my watch as if I am running out of time. Consequently, I find myself responding to a number of questions related to the unit, its assessment system and classroom proceedings. In*

> Aside Story: Celebrating dogmatism and purity of mathematics (cont'd…)
>
> Episode II
>
> It can be any day in June, 1994. I set out to lecture grade five students on why it is important to rote-memorise some important definitions of geometric concepts. A recent graduate of a teacher education department, I am very enthusiastic about using Pavlov's and Thorndike's theories of learning. My notion of stimulus is a well crafted explanation of key definitions of geometry and students' reproduction of those definitions without any distortions in the response. With this idea of S-R bondage, I begin to start defining and discussing the definitions of geometric concepts, such as point, line, triangle, and rectangle. As I finish explaining the definition of point, a big rainfall starts disturbing my lecture as the rain creates a lot of noise on the tin roof. How can I challenge Nature? I order my students to read definitions and be ready by the end of this class. Now the textbook (together with my command) becomes a stimulus and their rote memorising becomes a response (I guess!). As the rain stops, I conduct a quick check so as to find out if they are able to memorise correctly. I end the class by repeating my usual caveat: Don't ever try to modify the definitions. If you modify them, you won't get anywhere.

[57] I had used Paul Ernest's (1994c) book, *Mathematics, education, and philosophy: An international perspective* as the main text for this unit

the meantime, the two missing students arrive in the class with an apologetic smile that they turned up a little later than the stipulated time.

I start my presentation with a statement that mathematics is a socially constructed knowledge system. I try to prove this 'statement' by condescending and deconstructing (almost rejecting) the conventional view that mathematics is an incorrigible knowledge system. I quote some sections from the papers of Sal Restivo, Tony Brown, Paul Ernest, Steve Lerman and Reuben Hersh to prove this statement. I declare that the conventional view of the timelessness of mathematical ideas is just a trick for converting mathematics teachers and mathematics professors into tyrants. By saying this, I am about to complete my fifth slide. Although my 'inside' is not really happy about the way I utter this last statement, I pretend that I am sure and certain about the 'supremacy' of the nature of mathematics as a socially constructed knowledge system over the conventional nature of mathematics as a body of pure knowledge.

Aside Story: Celebrating dogmatism and purity of mathematics (cont'd…)

Episode III

It can be any day in August, 1994. I may be teaching to grade three or grade four students. The sunny and hot day seems to have caused us a nuisance. I announce to the class that I will be starting the topic of division of fractions and I expect them to behave well during my demonstration of the algorithmic procedure for solving problems, such as 8/9 ÷4/5 and 2/3 ÷6. I demonstrate the procedure of dividing up a proper and improper fraction by a whole number and fractions. I draw pictures to illustrate the method of division, which involves changing the sign of division into the sign of multiplication and replacing the divisor by its reciprocal fraction. I then tell them to skip exercise 4 (a) which asks students to solve the division related problem by drawing fraction models (pictures). I tell them that picture drawing does not help them to be perfect in capturing the crux of mathematics which is all about using the right method in the right place with a set of right algorithms. I am not sure whether the tiny kids have got my professing quite right, but I am sure that they have not liked my idea of skipping the exercise in which they could draw pictures as a means for solving the algorithmic problem of the division of fractions.

As I am about to pause my presentation for a moment, my eyes are captured by a flock of birds flying in the sky. The pattern they follow looks like a modulating wave that changes its intonation and speed. Why are they going up? Perhaps, they want to watch the sunset lively. I swiftly bring my eyes back to the classroom so as to show that I am well focused in my business. I try to read the face of each student as a *means for reflection in action. Most of the faces appear to be gloomy as if they are watching either a 'serious movie' or a 'horror show'. "Do I also feel the same way about my own presentation?," I question myself in my internal world, looking at a colourful screensaver being presented on the whiteboard.*

"We shall discuss these issues in our cooperative groups. And, these ideas will reappear in each and every class of this unit, well, at least in my units," I try to pacify an apparent anxiety among the students. "So far, I have discussed why the nature of mathematics as a socially constructed knowledge system is more empowering than the conventional nature of mathematics as a body of pure knowledge. In so doing, I share different philosophical viewpoints that justify the importance of mathematics as a socially constructed knowledge system," I reassert my position, looking at every possible nook and cranny of the classroom.

"What are the consequences of depicting mathematics as a socially constructed knowledge system?," I speak rhetorically, navigating my remaining slides. "Rather than being an incorrigible knowledge system, in actuality, mathematics becomes a contingent and corrigible knowledge system. Therefore, it is high time for mathematics educators to bid farewell to the idea of time- and space-free notion knowledge as the main feature of mathematics that we teach." I then explain the need for embracing this heretical view of mathematics so as to challenge the existing elitist view of mathematics as a subject for some bright students. "Indeed, a strong message is to be spread out among the mathematics

> Aside Story: Celebrating dogmatism and purity of mathematics (cont'd…)
>
> Episode Four
>
> It can be any day in October, 1994. The autumn day looks very beautiful with marigolds blossoming around the school compound. I am teaching the topic of tessellation to the grade five students. I follow the book so as to explain the rule of tessellation (i.e., pavement design) with various geometrical shapes including triangle, quadrilateral and hexagon. I use the blackboard to draw a sample pattern that uses triangle and hexagon as the basic shapes for designing a pavement. Then, I write probably six rules for making pavement designs through combinations of different geometric shapes. I tell them that these rules are really important for their final exams. In my mind, the tessellation rules are set for an item for a multiple choice question. This announcement causes students to pay full attention to my divine-like explanation about those rules. As I am about to finish the class, one student shows how he uses marigold pattern to design a pavement plan and asks whether they will be asked to produce an actual design. I say to him that designing is not part of mathematics, so he better stick to the rules which are very important for their final exam.

education community that the notions of universality and objectivity are worthy to be a forgotten project thereby introducing other qualifiers such as subjectivity, contextualism, contingency and relativity to account for this new set of ideas about the nature of mathematics." I generate these claims on the basis of views extracted from a number of papers written by recent researchers of the field of the philosophy of mathematics and mathematics education. I also take this opportunity to critique briefly the Formalist and Platonist philosophies for their (alleged) view of mathematics as a symbolic, abstract and pure body of knowledge. "But I will unpack these disempowering philosophies in our upcoming discussions," I rescue myself from a possible philosophical deliberation.

According to my previously announced plan, there are no more than five minutes left for the presentation. So I quickly chart through the remaining two slides. "Perhaps these new ideas about the view of mathematics give rise to the perspective that there are multiple mathematical knowledge systems arising from the social and cultural practices of people. Nepal, being an ethnically, linguistically and culturally diverse country, has many mathematical knowledge systems embedded in its social and cultural landscapes. Why don't we use these knowledge systems instead of promoting Euclidean and Pythagorean thinking? Why don't we turn to our own social and cultural milieus to make sense of mathematics in a meaningful way" This final statement seems to help students change their worried faces to somewhat smiley faces. But still, my 'pragmatic self' is unsure about the extent to which this rhetoric filled preaching helps prepare agents for an inclusive mathematics education.

Prologue

The story, *Farewell to Euclid and Pythagoras: Mathematics is not a universal knowledge system*, depicts my experience as a radical teacher educator who strives to develop an inclusive and transformative vision for mathematics education in Nepal. Similarly, the aside story, *Celebrating Dogmatism and Purity of Mathematics*, excavating some of my teacherly selves, gives rise to a set of in/visible moral, political and cultural hegemonies orienting mathematics education in Nepal. By storying my experiences, I am re/creating my professional landscapes with a host of, frames and spaces that have been closely associated with my endeavour to radicalise mathematics education. As I construct textual representations based on my experience, a vivid image of students arguing for and against the heretical views of mathematics embedded in Social Constructivism (Ernest, 1994c), Radical Constructivism (Cobb, 1994), Ethnomathematics (D'Ambrosio, 2006) and Critical Mathematics Education (Skovsmose & Valero, 2001) provides me with a bumpy site for critical reflection of my own pedagogical thinking and actions. I use the metaphor of 'bumpy site' so as to indicate potentially disempowering paradoxes and contradictions that often prevent me from acting justifiably so as to transform mathematics education in Nepal. What might be such disempowering paradoxes and contradictions that are prevalent in my approach as a teacher educator? Can they be propositional, deductive and analytical logics (henceforth, conventional logics) that appear to be un/wittingly orienting my actions as a teacher and teacher educator? Perhaps I say yes to this question because it appears to me that the logics embedded in my pedagogy as a teacher educator do not seem to be much different from the logics embedded in my earlier pedagogy as a teacher who celebrated exclusively the view of mathematics as a body of unchanging, certain and indubitable knowledge (see Section One).

With these questions in mind, my task is likely to be that of a confessional protagonist who shares his experiences of the disempowering nature of the key conventional logics that prevents mathematics education from being inclusive. Constructing stories of my pedagogical practices as a teacher and teacher educator and writing previous sections of this thesis (i.e., Section One, Two and Three), I have generated some glimpses that an exclusive use of conventional logics may not be useful for developing a vision for a transformative mathematics education. This epiphany encourages me to undertake a journey of exploring meanings, historical evolution and disempowering features of these conventional logics. However, rather than embracing an exclusive analytical lens, I am planning to accomplish this task by telling stories embedded in my nascent reflective-storied genres.

Constructing Meanings of Old Logics

I sense that the threatening shadow continues to follow me until I arrive at the shade of the Banyan tree. The tree seems to have magical powers that protect travellers from ghostly images and beastly animals. I glance at the divine like tree from its widespread root to its unreachable branches, and bow down for its helping attitude. I *stay very close to the tree so as to avoid an untoward encounter with the beastly creatures approaching on the narrow track. Where should I go from here? Can I refuge under this tree forever? Agitated by annoyance, fear and aimlessness, I hesitantly step out from the vicinity of the tree.*

(Dream Diary #2)

I begin this journey with a brief mention of hypothetico-deductive thinking, a key source of *old* logics orienting mathematics pedagogies in Nepal. It seems to me that hypothetico-deductive thinking promotes dualism via its emphasis on narrowly conceived analytical logic which seems to become a source of many unhelpful dichotomies. More so, the hypothetico-deductive thinking appears to be a key basis for privileging propositional and deductive logics which license reductionism in pedagogical aspects of mathematics education (see Section Three). In what follows, I articulate these three *old* logics (i.e., propositional, deductive and analytical) on the basis of my life roles as a conventional teacher and a radical teacher educator and their possible implications for mathematics pedagogy.

a) Propositional logic: Literally speaking, propositional logic seems to have confined me to a world of rigid categorisation and conceptualisation to verify casual explanations that are imputed upon realities around us (Tieszen, 2005). Perhaps, this logic caused me to ignore largely the value of context in the process of radicalising mathematics education because of its insufficiency to account for complexities associated with the notion of context. Although my heretical perspective about mathematics education can make a significant difference in the field of mathematics education in Nepal, the propositional logic embedded in my professing seems to have been generating yet another definitive view of mathematics education. Upon reflection, I realise that definitiveness and finitude to be the main features of propositional logic that treats language as a conduit of fixed meaning. What happens when language is treated as a mere conduit of fixed meaning? Perhaps, sounds, words and sentences become associated with single fixed meaning, thereby depicting them as first and final.

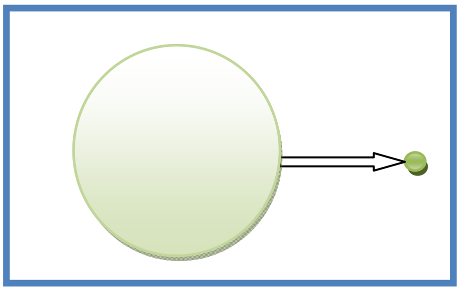
Metaphorically, the notion of a Euclidean straightedge can depict the nature of propositional logics. For me, a 'Euclidean straightedge' privileges a particular view of reality in which each object (of our reality) is likely to be straight as a standard ruler (Davis, 2005). This straightedge view of reality is exclusive of aspects of realities which appear to be 'non-straight' and 'non-smooth'. As I reflect upon my approach to justifying a heretical view of mathematics education, I detect myself following a Euclidean straightedge thinking as though the conceptual landscape of my professing was straight and smooth. Furthermore, I was using ('capital p' Philosophical) assertive statements about this view of mathematics as linguistic straightedges, thereby ignoring the swampland of the lived realities (i.e., 'small p' philosophy) of my students and myself.

In an attempt to unpack my earlier ineffable experience of propositional logic, I now delve into my inner consciousness which constantly questions the presumptuous nature of propositional logic. Perhaps, the following poetic depiction of my inner landscapes reveals some disempowering aspects of this logic.

Where is my voice?
Concealed in dry statements
Trapped in ethereal ideas
Again it questions
Am I a slave of dry texts?
I say to my voice
Don't make a noise
Start minding the proposition
Conceal the humdrum opinion
Again it questions
Am I not worthy of consideration?
I say, these are big ideas
'Caused by' and 'causes of' other ideas
My voice questions
Cannot the chain of causation be in your mind?
Cannot that be simply your interpretive imposition?
My voice gradually coming to the forefront, says
Exclusive use of propositional logic may make life defunct
Because it seems to promote a singular yardstick
for constructing a statement
for depicting the truth
If I am forever to be colonised by propositional logic
How can I ever see present fuzziness?
How can I account for blurred images?

b) Deductive logic: Reflecting upon my use of deductive logic as demonstrated in the stories, Farewell to Euclid and Pythagoras and Celebrating Dogmatism and Purity of

Mathematics, reminds me of the notion of deductive logic is reducing a law-like statement to a statement that represents particularity. Popularly known as a modernist way of thinking (e.g., Walshaw, 2004b), deductive logic can also be explained as a process of moving down from unchanging ethereal principal to context-based



examples as if the later are always in mercy of the former (Goldstein & Brennan, 2005). The analogy of moving down can depict the way in which I tried to present a new philosophical generality as an exclusive basis for generating a de-contextualised (because it was not related with the lived experiences of teachers) prescription for mathematics education. Privileging philosophical generality over the practice-based lived narratives of Nepali teachers and teacher educators may have promoted the view that Philosophical statements are superior to local and lived narratives. Perhaps, I might have been colonised by the conventional logic given the widespread view that the use of lived narratives would make me a substandard teacher and teacher educator. Needless to say, the notion of deductive logic seems to promote an orderly view of reality in which so-called general principles and rules are mapped onto a host of unique local narratives[58] (Egan, 1997).

In my mind, another notion of deductive logic entails the analogy of controlling the periphery (particulars) by the centre (universals). What does the notion of centre represent in my meaning of deductive logics? Upon reflection, the so-called centre is represented by rule-, formula- principle- like statements (Long, 2001), whereas practice-based narratives are believed to be situated in the periphery. For instance, my statement that mathematics is always a contingent knowledge system might have been depicted as the centre, thereby projecting the lived practices of Nepali teachers and teacher educators as peripheral constructs. It could be due to this image of deductive logics that my narrative self was constantly agitated by my exclusive

[58] Kieran Egan regards this phenomenon as philosophical understanding which is strongly guided by assertive and deductive logics.

privileging of so-called the 'centre statements' generated via philosophical perspectives which un/wittingly subdue the narratives embedded in the students' and my lived realities.

Now my journey of constructing meanings of deductive logic arrives at a detour of my experience as an undergraduate student who strived to make sense of many theorems of calculus. It may be because of deductive logic, among other forms of conventional logics that I was not able to think outside of self-serving justificatory chain of command. The chain of command metaphor conveys an image of a deductive procedure in which a set of principles/rules/formulas would control the result/answer/outcome of a mathematical problem. As a student, getting the correct answer through a pre-specified, mechanical procedure satisfied me because it reflected in receiving a good grade in tests and exams. Perhaps this immediate goal of being satisfied with a good grade can be compared with the Upanishadic notion of Preyas, a means for short-term personal pleasure that barely helps in sustaining long-term happiness (i.e., Shreyas) (Muller, 1955). Retrospectively, my exclusive use of deductive logic might have contributed to depict mathematics education as an exclusive-elitist enterprise, thereby not turning it out for a source of Shreyas for many students if not all.

c) Analytical logic: Etymologically, the term 'analysis' emanates from the Greek word, analusis, which depicts a host of meanings: dissolving, setting apart, loosening and pulling out (Guthrie, 2003). What does analytical logic represent, then? Perhaps

an extreme emphasis on analytical logic promotes a compartmentalised view of the world in which to divide up conceptual constructs into a number of components thereby privileging a few of those categorical components (Wolcott, 2001). For instance, the signature story of this section (Farewell to Euclid and Pythagoras: Mathematics is not a universal knowledge system!) seems to depict that I was unknowingly separating the conventional view of mathematics from the heretical view as if they are really separated, demarcated and cordoned off. Can this logic not promote one-sided view of reality? Might analytical logic not have contributed to an exclusive view of mathematics education?

Let me explore further contextual meanings of this logic by extending my story. Immediately after finishing my presentation about the heretical view of mathematics, a student raised a question: Does this mean that I should forget about the universality of mathematics? Am I totally wrong in terms of the view of mathematics that I have been holding till now? I do not remember exactly how I responded to him. Nevertheless, I have glimpses of what I could have said to him. Perhaps, I said to him that he got that right because, according to the logic that I have embedded in the heretical view of mathematics (and mathematics education), universalism and contextualism cannot go together. This 'cannot go together' can be linked with the notion of the 'excluded middle' which is considered to be a major feature of analytical logic (Smith, 2003). The message of this feature is that the middle ground has no use in our thinking and acting; that the extreme two edges are the only possibilities; and that middle ground is impure because it mixes up contrary constituents.

Therefore, arising from the notion of the 'excluded middle' there results a dualistic entanglement between contrasting categories of the same conceptuality. For instance, whilst some researchers are busy assaulting the heretical view of mathematics (Rowlands & Carson, 2002, 2004), I seem to have been performing the otherwise. However, there appears to be not much difference between the logic that governs anti-heretics and my heretic self in relation to the nature of mathematics. Perhaps, being colonised exclusively by analytical logic, there is a Himalayan-size difficulty in realising that the phenomenon of setting apartheid between different perspectives may limit our creative imagination. Does not a perspective-based apartheid promote an essentialist view of mathematics education? Here, the essentialist view lays emphasis on the belief that mathematics education is fixed, unchangeable and static.

Constructing Unhelpful Features of Old Logics

As the humanlike image shows its mystical appearance, I quickly remember the purpose of my walk. The image indicates that I need to keep on walking no matter what situation I face along the way. Somewhere in the corner of my consciousness, I have a feeling of revolt against the humanlike image as s/he seems to be framing me in this horrible unknown jungle. Nevertheless, my positive consciousness soon takes *over these unhelpful fillers and orients me toward an uncanny pathway that abruptly meets a station where I am permitted to dry off my sweaty body.*

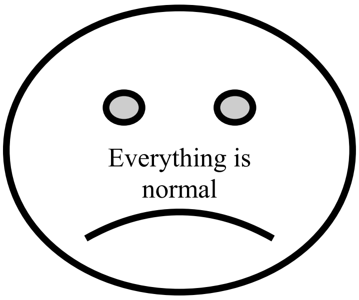
(Dream Diary #3)

Although my writing of the previous part of this chapter might have explicated some features of the key conventional logics, I am planning to explore them in greater detail and depth. Can I not be allowed some degree of repetition and redundancy so as to make better sense of the holistic nature of narrative representation? Here, my notion of holism is not about making my narrative perfect, rather it is about accounting for possible vocalities that I can capture through a number of transgressive texts (Olesen, 2000). Keeping this view in mind, I next explore key features (control, disembodiment, essentialism, rationality) of old (i.e., conventional) logics which seem to prevent mathematics education from becoming an inclusive enterprise.

a) <u>Hegemonic Control</u>: Why do I consider control as one of the main features of conventional logics? Reflecting upon my experience as a mathematics teacher in a school in Kathmandu in the early 1990s and as a radical mathematics educator sometime in 2006 , I seem to remember my tendency to use conventional logics as a means for keeping my teaching (and preaching) *under control* as if it might escape my hand. As a conventional teacher, perhaps I established the reign of pre-existing mathematical knowledge (theorem, formula, mathematical definition, algorithmic solution) via an impositional warrant of propositional logic. This teacher image does not seem to be much different from an authoritarian ruler who would try to control his/her subjects through thought-to-be unchangeable propositions (legal statements). Indeed an extreme use of propositional logic becomes an instrument of control by reducing multiple possibilities of language representation to a single-valued statement. Cannot there be situations in our lifeworlds that need multi-valued representations?

Reflecting upon my role as a teacher, I remind myself also of how the top-down approach embedded in mathematical algorithms influenced strongly my pedagogy (Fleener, 2002). Perhaps, deductive logic curtailed the imaginative creativities of myself and my students. This logic seems to have made my life easy because all I needed was to follow a verificationist mode of pedagogical enactment. Here the notion of verificationism entails the view that my teaching did not encourage students to look for mathematics from within their lived reality, rather I directed them to verify pre-existing mathematical truths[59] (Ernest, 1994c). Perhaps, by employing a narrow form of verificationism, I might have exercised control of one form of mathematics (pure: decontextualised, formal, abstract) over another (impure: informal, artefactual, contextual). While peering through the window of my experience as a mathematics teacher, I now visualise my 'radical mathematics educator' self also promoting exclusively a top-down mode of reasoning with an interest in the strong control of Philosophical ideas over lived realities.

As a conventional teacher, I had un/wittingly trimmed down students' responses to my questions to two categories: yes and no. Oriented exclusively by analytical logics, I could have been promoting a framework that may not have allowed my students to see beyond the possibility of yes and no. Thus, by controlling through a host of hierarchical dualities (minus and plus, pass and fail, inside and outside) I could have been delimiting possibilities of my students' seeing and interpreting their realities (Dunlop, 1999). Reflectively speaking, such control over students' worldviews could have resulted in the unhelpful perspective that mathematics might not help in dealing with realities that are complex and have multi-truths. Perhaps, the following poem can represent (impressionistically) how I, as a conventional teacher, retained hegemonic control over my students' situated knowledge by using an exclusive form of analytical logic.



Don't ever talk about early mornings
Because they are neither days nor nights
What can you do with fuzzy, hazy and unclear?
Say no to in-betweens; stay either here or there.

Fuzzy twilights have no defined opposites
How can you live in the mess of mix?

[59] Whilst teaching the theorem, angle sum of triangle is 180^0, I did not pay attention to the fact that 180^0 is an ideal; I did not allow students to explore themselves that 180^0 is an ideal approximation. Rather, I put emphasis on making sure that they got 180^0 as the result of verification.

Section Three

Draw a clear boundary between you and not you
Remember if you are false 'not you' is always true

See the world as a host of opponents
Talk about roses and forget the thorns
If someone says
You can find meanings in-between and beyond
Tell him/her that this is just a mythical mayhem
Because our evidentiary frame-eyes cannot prove them

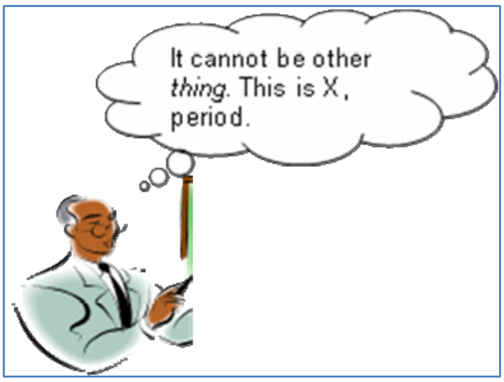
So don't talk about ever unprovable
Stick to what you can make a black n white tale
Remember if I am right you are wrong
Which is why you are here to learn?

b) Disembodied knowing: "Can you stay alive without your bodies?" An anti-Cartesian self inside me raises this question after reading the famous Cartesian dictum that our mind is disembodied (Lakoff & Johnson, 1999). The means by which Rene Descartes arrived at this conclusive dictum appears to be the propositional logic embedded in his philosophical discussion, the deductive logic entrenched in his verificatory mode of knowledge claims, and the analytical logic underlying his dualistic model of reality. Revisiting my role as a conventional teacher, I remember promoting a mode of teaching that rarely involved my students' bodies.

Metaphorically, the notion of body signifies action, activities and the cultural situatedness of my students. Retrospectively, perhaps I privileged the dry and cold voice from grand-narratives (standard mathematical texts) with the help of propositional logic, an exclusive form of which privileges knowledge that could only be reasoned by minds rather than felt by bodies (Doll, 1993). Even if students felt something, the pre-defined hammer of deductive logic would prove their feelings unprovable. Implicated in this process, analytical logic would prepare the ground for disembodied reason by depicting my pedagogical world as divided into a set of two exclusive opposites: either yes or no; either body or mind; either mathematical or non-mathematical. Given this exclusive reign of conventional logics, it would be unthinkable for me to admit at the time that I need to chart my pedagogical journey by holding these opposing categories in a dialectical tension.

My professional self as a radical teacher educator has a similar story to share here. I seem to have been overly submissive to the logic of minding rather than the logic of bodying, hearting and soul-enacting. Minding can be depicted as a way of playing the philosophical games of proving and disproving ideas rather than minutely inquiring into the world of lived experiences (Clandinin & Connelly, 2000). Perhaps guided by propositional logic, I was overly asserting a set of selective views of mathematics (and mathematics education). Retrospectively, those assertions do not seem to have been inclusive of narratives of local practices, rather they were disembodied claims similar to the claims of mathematical algorithms that I made more than a decade ago. Perhaps, un/knowingly with the help of deductive logic, I had intended to prove that the assertions were true. Admittedly, I did not need necessarily to use an algorithmic structure guided by deductive logic *per se*, but I used a deductive mode of reasoning in order to show how the world of 'Ideas' fit seamlessly. The more I was coherently presenting the world of Ideas, the further I was separating the philosophical texts from lived realities. Perhaps, I was interested in proving (an act of disembodied knowing) that mathematics is not universal, thereby (ironically) closing a window to an inclusive view of mathematics education. In a nutshell, analytical logic seems to have provided me with a basis for creating a borderline between philosophical ideas and ideas arising from the worlds of lived reality.

c) Disempowering Essentialism: As I begin to explore yet another key feature of conventional logics, I vividly confront an essentialist image of mathematics as a subject of fixity and infallibility. As a conventional teacher, my emphasis was on an essentialist view of the nature of mathematics, meaning that mathematics *was* never going to change for me and my students. At that point in time, I held the view that mathematics is always the same, unchangeable and unalterable. Although I am not certain whether it is essentialism that gives rise to the conventional logics or vice versa or whether there is something that binds them together, my experience reminds me that conventional logics can be instrumental for sustaining an essentialist



view of school mathematics which promotes an elitist posture of mathematics education. As a conventional teacher, perhaps I cultivated an essentialist view of mathematics by privileging a particular mode of reasoning (detached, disembodied, heartless, cold, dry, *gender-insensitive*), whereas my 'radical mathematics educator' avatar promoted yet another form of essentialism that mathematics is a totally contingent system of knowledge. Let me unpack (so to speak) the essentialism-inspiring feature of conventional logics taking on board the notions of ontology, epistemology and axiology.

Enacting my narrative as a conventional teacher, a deep-seated memory of my situatedness reminds me of promoting a never-going-to-change view of mathematical axioms, definitions and algorithmic structures. The propositional logic that I used for asserting various knowledge claims privileged a particular form of genre to represent reality. With an exclusive emphasis of the prosaic declarative language game of propositional logic, perhaps I privileged an essentialist view of reality as unchangeable Forms as mentioned by Plato (Sriraman, 2004). The rigid algorithmic structure bestowed by Formalism might have encouraged me to maintain the view that mathematical reality is essentially symbolic and abstract (Hersh, 1997). Needless to say, an exclusive form of analytical logics did not allow me to go beyond the dichotomised view of reality, thereby backing the ontological model of "*A* and *not-A* do not, cannot and should not go together". For me, a deeply-entrenched view within this formulation of analytical logic is that *A* and *not-A* always have unchanging essences to keep them apart, to treat them as different entities (Goldstein & Brennan, 2005). In a nutshell, perhaps this ontological essentialism colonised my thinking so as to see mathematical reality as fixed, unchanging and pure.

Did I, as a radical mathematics educator, try later to minimise the hegemonic influence of essentialism arising from an ontology of naïve realism? Although I was promoting the view of mathematics as a contingent knowledge system, the logics in my pedagogy might have essentialised mathematical reality as dualistic. Indeed, my exclusive preaching that the view of mathematics is not universal may also be disempowering because it could have promoted elitism in mathematics education. My alternative to *this* ethereal 'Idea' was *that* ethereal 'Idea' (Boas, 1973). Thus, I might be promoting yet another form of ontological essentialism namely that every view (be it conventional or heretical) of mathematics education is generated from the world of ideas rather than the world of lived realities.

As a conventional teacher, my pedagogy appears to have been guided largely by the metaphors of *knowing as imitating, probing and proving*. Possibly, propositional logic enforced my students to be assertive knowers who needed to be certain about everything. Perhaps, deductive logic indoctrinated them to acclimatise to a number of unpacked assumptions, thereby making them blind followers of *formal* and abstract (i.e., pure) mathematics. I argue here that the analytical logic acted as a license for promoting the metaphor of *knowing as dichotomising reality*. As a teacher educator, perhaps my epistemology of teaching was somehow different from my epistemology as a conventional teacher, as I introduced cooperative group discussions after my presentation. Nevertheless, these groups were largely restrained by my image of *knowing as probing* via philosophical assertions, ruthless deduction and exclusive analytical reasoning. Indeed, my exclusive emphasis on assertive, deductive and analytical thinking might have re-established an essentialist view of knowing as asserting, deducing and analysing (Granger, 2006).

Beside these ontological and epistemological essentialisms, the excessive use of conventional logics seems to have promoted a package of value essentialism. Remembering my role as a conventional teacher, I did not encourage my students to explore the basis upon which to value certain forms of mathematical knowledge. In the mask of value-free-ness, a profound form of value was being injected through these three logics. It is my heartfelt view that the assertive nature of propositional logic, being a rendition of Euclidean straightedge, unwittingly but profoundly promoted the value of the Euclidean paradigm. With this flatland notion of goodness, perhaps my excessive use of deductive logic hardly opened a vista for other forms of reasoning (Davis & Sumara, 2005). Retrospectively speaking, an extreme form of analytical logic might have acted as a moral police force deciding which mathematics is good and which mathematics is bad. As a radical teacher educator, although I was preaching (but not necessarily practising) for a non/essentialist[60] view of mathematics for an inclusive mathematics education, my pedagogy seems to have espoused a form of value essentialism arising perhaps from the declarative, bounded and dichotomised nature of knowing that I prompted. My exclusive use of these three logics might have helped prevent student-teachers from realising a dynamic, non/essentialist and transformative vision of mathematics education.

d) Narrow view of rationality: As I start writing this section, I become anxious about the potential redundancy in my texts due to the overlapping themes that I have chosen to facilitate my inquiry. My anxiety seems to emanate from the deeply-seated notion of rationality as an act of producing seamless ideas as if there are no jolts and joins in the reality (of ideas). Reflecting upon my role as a conventional mathematics teacher whose pedagogy was guided exclusively by it-centric assertive language, I realise that I had been preventing local worldviews coming into contact with the mathematics that I was teaching. My way of using the three conventional logics seems to have promoted a narrow view of rationality that quarantines empathy, mindfulness and embodiment. Was I inviting the ghost of Plato, Descartes and Aristotle (Hager, 2005) who suggested that we dissolve our emotions and who willed us to acquire (cf. construct) an ideal and disinfected form of knowledge?

The three conventional logics seem to have played a significant role in developing a narrow view of rationality. As a conventional teacher, perhaps propositional logic facilitated me in distanciating myself from contextual meanings of the mathematics that I was teaching. Perhaps, an exclusive form of deductive logic rendered me blind to other forms (i.e., poetic, metaphorical, *abductive*, inductive, non-linear,

[60] Non/essentialism is my approach to representing a dialectical relationship between essentialism and non-essentialism, for which an entity can be inclusively perceived to have some essential unchanging qualities whilst largely considered to be non-essentialist. The idea of non-essentialism is to consider that any object or entity does not entail any unchanging attributes.

dialectical). It may be the case that an exclusive emphasis on analytical logic furthered the ecstasy of generating ruthless “yes-versus-no” claims, thus limiting the possibility of the *what* and the *how* of reasoning.

Can I claim that my role as a teacher educator escaped the grip of narrowly conceived rationalism? This question helps reveal the mode of reasoning un/wittingly embedded in my preaching. Although I was arguing for an alternative powerful view of mathematics that can serve as a referent for an inclusive mathematics education in Nepal, it seems that I was unwittingly endorsing a dispassionate, disembodied and decontextualised cognitive reasoning oriented by the three conventional logics. I can say that my assertions about the view of mathematics as a socially constructed knowledge system might have challenged the longstanding view of mathematics as a body of knowledge (see Section One), but they seem to run along a rather unsustainable track of reasonableness created by the conventional logics-inspired language games. For me, the notion of an unsustainable track of reasonableness indicates the narrow view of thinking as exclusively disembodied acts, as if the body and mind are inseparable and irreconcilable entities.

In both my roles as a mathematics teacher and teacher educator, I might have promoted an unhelpful and elitist view of learning as exclusively reproducing ‘assertive knowledge’ (Hager, 2005). In my mathematics classroom, students were encouraged to reproduce definitions, formulas and theorem-statements, seemingly enforcing a Euclidean flatland view of the world purported by the conventional logics. In a nutshell, in my teaching of the *mathematics education* unit, I was challenging the apparent source of the assertive ‘knowledge paradigm’ but seem to have been unaware of the major source that enforces an exclusive view of rationality restricted to assertive-deductive-analytic thinking.

CHAPTER 10: JOURNEYING WITH NEW LOGICS: CREATING TRANSFORMATIVE AND INCLUSIVE PEDAGOGIES

I incline my body on the gently terraced ground. I can see the sun from here and it is more wide and open than ever before. I care about the humanlike image and begin to delve into a retrospection of my journey. I agitate, cry and then relax whilst I remember my struggle of finding a proper, unbounded and fearless track. The beastly jungle still haunts my thinking. I remember how fearful it was not being able to walk properly on the track with nails, pebbles and bumps. Restricted by a number of do's and don'ts, I could nearly lose the way and fall into the mouth of a dangerous beast. I hope now I need not go back to the same jungle again. Even if I go there, I will go with enough training and preparation to protect myself from narrow paths, beastly animals and darkness prevailing in the jungle.

(Dream Diary #4)

Pythagoras And Euclid Are Still Useful!

It can be any late afternoon in the month of April, 2006. Probably after five classes of mathematics education unit that have celebrated the heretical view/nature of mathematics as socially constructed knowledge system, I meet a group of students in the university café wanting to have an informal discussion about the views of mathematics that I have been sharing in the class. Imagining that the informal talks and chats can help establish a good rapport with students, I enthusiastically sit on one of the chairs attached to the table around which four students are being seated.

"How are you finding the classes on mathematics education?", I ask, taking a sip of hot tea. My question hangs around for a while as if it is waiting to be responded to. I notice that all of them confusingly look at each other, hoping the next person will break the ice. Possibly, after a minute's silence, one of them starts with a positive tone.

"Yes, the sessions are great. They offer very fresh perspectives about the emerging views of mathematics and mathematics education. It is good to know how the recent philosophers are shaping up this rather conservative knowledge system", Ramesh continues with a chew of Samosa. "I think the unit challenges our existing assumptions about mathematics that we teach almost every weekday."

Ramesh's response is not very unsurprising because he has been my students since 2004, first in a year-long diploma program in education and now in a masters program in mathematics education. As he speaks in favour of my preaching, I come to realise that the logic of relationship defines the politics of voice, critique and question. I remember for the first time when Ramesh vehemently argued for an all-encompassing objectivist view of mathematics education. He converted into the heretic camp after four/five sessions on teaching mathematics (a post-graduate diploma unit), in which he later completed a project on storying as a pedagogy of mathematics teaching.

However, my quick glance at the faces of the remaining three students tells me that they do not buy into Ramesh's version. Even if they do so they may opt it only for partially. Indeed these students are very new to me. Two have never been to teacher education courses, rather they seem to have graduated from programs in mathematical sciences. Having experience as secondary school teachers for about four/five years they can speak from a mixed perspective of lived reality and the conventional nature of mathematics as an indubitable knowledge system. But they are not well-versed in the terminology of philosophical games. The fourth student appears to have a bachelor's degree in mathematics education and a three-year long experience of teaching mathematics in a secondary school. He often claims to have known more about mathematics education than the other two who are new to the mathematics education program. However, he seems to be stuck within the frame of behaviourism, thereby finding it hard to gain acquaintance with the hi-fi language of postmodern heretics. He often brings interesting lived perspectives about mathematics education, but they hardly reconcile with my dualistic frame of 'almost no to Platonism, Formalism' and 'totally yes to heretical perspectives'.

"Well, do you want to say something, Mahesh?", I ask, taking one spoon of pea-potato curry, "You are open to raise questions and seek assistance if you are finding it difficult to make sense of issues discussed in class."

"I agree with Ramesh that your unit is sharing us an outlook about the nature of mathematics which is entirely different from what we have been educated to believe in. However, I am finding it hard to grasp these new terminologies and concepts associated with these philosophies", speaks Mahesh, grabbing a piece of roti[61] *with his right hand. "During my bachelor's studies, I had developed a view that philosophical argument is an unending game of words. Now, I am struggling to prove myself wrong."*

Mahesh's view is not unexpected as I had also felt the same way reading these ideas sometime in 2002 during my Master's degree studies. At this stage, I don't have a magic answer for Mahesh's diplomatic question, nor do I challenge his lived experience. Perhaps, I may offer him a technically minded suggestion: Familiarise yourself with new texts, see the pattern and connection of ideas and associate Master Ideas with the local narratives. But I don't really know at this stage whether the rejection of one view of mathematics and an exclusive celebration of another view of mathematics is a sustainable recourse to take?

"Sir, you indicated in our last week's class that we need to use our own knowledge system, a kind of Nepali knowledge system. In my life as a student of mathematics, I heard this type of idea for the first time. I share with my other friends who are stuck in their 'pure mathematics' course and they are excited about it. But your idea of abandoning Euclidean and Pythagorean mathematics does not make sense to me. How can I convince other teachers about this?," Prabhat questions with stretched eyebrows.

"Euclid and Pythagoras have used a particular framework, a flatland-smooth view of mathematical surface. My indication here is to reject the singular view of reality, which has been promoted by these conventional views of mathematical reality," I assert my view with a set of rhetoric that I have been using for the last three years. "Unless we replace this framework of mathematical surface by an empowering framework of fuzzy, curved and non-smooth mathematical surface, it is really hard to

[61] Local bread made out of rice floor

conceptualise an inclusive view of mathematics education." But I miss an important point here that realising fully an inclusive view of mathematics and mathematics education may require a set of logics that allow us to see inclusively and holistically.

"You may be right, Sir. But I have seen a serious problem here. How can we reject the Euclidean view of flatland surface because we cannot stay completely away from flatlands? Don't we need flatland in our life, ever? Don't we need different types of mathematics to solve contrasting problems in our life? " A rather quiet Shambhu speaks passionately.

I don't remember clearly how I responded to Shambhu, but we all part happily, agreeing that our next discussion will take place in my office. As they enter the computer lab, I keep contemplating about a best possible way to respond to Shambhu's question. Indeed, many Nepali teachers still believe strongly that Pythagorean and Euclidian ideas hold true always, but I need a way out for making them a partial truth rather than a hegemonic totality. How can I be inclusive of the utilitarian value of Pythagorean and Euclidean mathematical ideas? Which logics can help me generate a pragmatic, transformative and inclusive view of mathematics education?

Prologue

Shambhu's questions keeps on coming to the fore of my thinking as I start this journey of exploring other possible logics that might help generate an inclusive view of mathematics education in Nepal. Although I am not certain whether Shambhu was speaking from the vantage point of his lived experience or he wanted to play a game of unending monologue, I find his questions quite useful for this retrospective examination of my use of propositional, deductive and analytical logics and exploring possible new logics for an inclusive mathematics education. I envisage that my journey of searching for new logics is full of challenges due to the longstanding hegemony of conventional logics embedded in the field of mathematics education that might have trained me to speak through an assertive language guided by deductive-analytical reasoning. Do I aim to dispel totally the conventional logics, then? Perhaps, I am not intending to create yet another chain of perverse exclusion by rejecting the conventional logics. My renewed understanding about them is that:

the conventional logics are necessary but insufficient to explain the complexity enshrined in my thinking and action as a transformative educator.

I have chosen a multi-logics perspective so as to generate an inclusive view of mathematics education. I am using the idea of multi-logics in order to account for at least two sets of logics in my envisioning. My making of sets is quite contingent, and based upon my lived experience and narrative imagination. The first classification of these logics entails the category of conventional and non-conventional logics, whereas the second classification represents them as formal and post-formal logics. The formal logics are often considered to be guided by the Piagetian notion of hypothetico-deductive reasoning that may not account for the representational, linguistic and contextual complexities enshrined in our thinking, whereas the notion of postformal logic goes beyond the linear, deductive and dualistic model of reasoning (Hampson, 2007). The third set of categories can be represented as literalistic and post-literalistic reasoning. Literalistic reasoning seems to take the apparent meaning of 'letters' 'words' and 'sentences' as ultimate and real, whereas post-literalistic reasoning goes beyond such a naïve realism, thereby embracing embodied, magical, imaginative and creative realism (Denton, 2005b). There may be a number of such new (non-conventional, postformal or postliteral) logics, but I am planning to explore metaphorical, narrative, dialectical, and poetic logics in relation to my (thinking and) action as a teacher and teacher educator.

Metaphorical Logic

Turning my body to the other face of the jungle, I feel that I am wandering in the jungle for some days, weeks and years, without a much clearer path ahead. In the midst of some remnants of confusion and fear in me, the humanlike image appears again and points to a much wider path that appears on the horizon. I am unable to gauge the distance between the place and the horizon, nor does the humanlike image offers any clues. Uploading the image of the 'wide path' into the repository of my mind, I keep up my pace with optimism and a potentially joyous moment of finding a much more comfortable path in this wide rainforest.

(Dream Diary #5)

A definition of metaphor entails its notion as making sense of one concept in terms of unrelated another concept (Lakoff & Johnson, 1980). For instance, my depiction of mathematics as a body of pure knowledge can serve as an example of metaphorical representation. In this example, mathematics is understood in terms of a body of knowledge, similar to a container that contains objects and entities. Perhaps, through this metaphor, one can begin to see mathematics as a container and mathematical knowledge as objects and entities that are kept inside the container. As a mathematics teacher, I might have used the metaphor of teaching as controlling so as to depict my transmissionist pedagogy. Beside this, metaphorical logics are operated via parables, analogies, images and imageries so as to capture multiple meanings, perceptions and conceptions. Indeed, metaphorical logic is not restrained by the literal meaning enshrined in the concepts, instead they help pursue our understanding beyond bounded literalism. With this brief description, let me start exploring some key features of metaphorical logics with a language of introspection and possibility.

a) Empowering Non/essentialism: Arriving at this detour, I am planning to search for some key features of metaphorical logics by using my lived realities as a teacher educator and a mathematics teacher. Perhaps my searching for some features of metaphorical logic is also "metaphorical" in a sense that it can be represented by the metaphor of inquiry as an emergent journey that evolves along the way. In taking this detour, I begin to think about the idea of a potentially non/essentialist posture of metaphorical logic that could improve my thinking and actions as a mathematics teacher. Perhaps, by embracing metaphorical logic, I could have facilitated my students to go beyond the literal definitions of mathematical terms and concepts, yet not excluding totally the literal aspect of mathematics. This holonic[62] transcending of essentialism by non-essentialism could have contributed to developing a layered understanding of mathematical concepts. My idea of holonic transcending of

[62] Inclusion of lower conceptual and perceptual categories into higher order consciousness (Wilber, 2000c).

essentialism represents a dialectical-integral vision (Basseches, 2005) in which non/essentialism includes both essentialism and non-essentialism. The non/essentialist feature of metaphorical logic could have also played an important role in improving my pedagogies as a teacher. If I had been aware of this logic, I could have promoted '*as though'* thinking (as opposed to extreme 'is' thinking) so as to embrace non-essentialist aspect of teaching techniques. Even while dealing with the content of school mathematics, I could have considered various forms of metaphors (simile, analogy, metonymy, images) so as to expand the essentialist view of mathematics as a body of pure knowledge (Lakoff & Nunez, 2000). I remember how I struggled to make sense and help my students understand the concept of point which the prescribed textbook had defined literally as a dimensionless geometrical object. Retrospectively, the essentialist-literal language of 'is-ness' could have impeded my thinking for a long time.

My role as a teacher educator who wanted (and still wants) to transform Nepali mathematics education might not have been fully aware of this form of logics. Although, I had used (perhaps simplistically) images and imageries to generate heretical views of mathematics as a means for developing an inclusive mathematics education, I could have been essentialising some of the imageries (activity, social construction, contingent knowledge, nonuniversal, contextual) as if they are *real* entities. Perhaps, my approach of exclusively celebrating heretic views of mathematics could have emanated from narrow literalism that could be residing sub-consciously in my conceptual profiles. This seeming 'realness' often promotes essentialism, thereby not helping me to articulate *as though*-ness embedded in metaphorical thinking. If I was to fully realise the use of metaphorical logic, I might have taken *mathematics as an impure knowledge system* (see Section One) as one possibility out of many. Perhaps, I could promote the view that there can be as many metaphors as we can imagine. If I had chosen this pathway, students wouldn't have experienced anxieties about learning because a fullest possible use of metaphorical logic allows openness and creativity in interpreting phenomena available to us.

b) Embodied realism: This important feature of metaphorical logics helps generate a view of realism that accounts for our lived experiences, one of the bases for which to make educational endeavours meaningful. Unlike in the exclusive use of narrow literalism which promotes a correspondence theory of truth and accounts for only apparent meaning of concepts, the use of metaphorical logic accounts for conscious (literal), subconscious and unconscious meanings of a concept under consideration. Perhaps, it is contextual to mention Lakoff and Johnson (1999) who seem to dispel the exclusive celebration of a correspondence theory of truth as a source of

disembodied realism which has been dominating the thinking and actions of many mathematics educators. Embodied realism provides me with a referent for questioning narrow objectivism as well as extreme subjectivism that might be yet another impediment for embracing a transformative vision of mathematics education in Nepal. Indeed metaphorical logic can be an important tool for exploring various meanings of concepts, realising the fact that meanings of concepts under study are embodied (contextual, un/conscious, sub/conscious).

How could this feature of metaphorical logic have helped me in making mathematics teaching meaningful? Primarily, this feature of metaphorical reasoning would have encouraged me to use mathematics as a means for linking formal mathematical knowledge with informal mathematics knowledge that arises from our (bodily) activities. It could be a metaphorical logic that can play a catalytic role in developing a pedagogical approach for contextualised mathematics as a recourse to exclusive elitism promoted by the conventional logics. Even when dealing with algorithmic and abstract mathematical concepts, metaphorical logics can help generate multi-layered meanings and interpretations of mathematical concepts, thereby unpacking various dimensions of them. Considering embodied realism as a referent for my pedagogy, I would have been able to generate a context-based pedagogy that does not only involve students' minds but also involves hearts, bodies and souls.

My role as a transformative teacher educator could benefit from this feature of metaphorical logic in many ways. Perhaps, it could be embodied realism that can be an empowering referent for capturing practices of my students whose experiences as teachers are likely to generate very unique, contextual and pragmatic visions for transforming mathematics education from its extremely Platonic-elitist posture. In a similar line, an embodied realism could help negotiate various views of mathematics. The diversity of conceptual images and imageries could have been used as an outcome of body-engagement, thereby generating an inclusive vision of mathematics education. In this process, I could also use 'as though' reasoning as a recourse to dualistic interpretations of the view of mathematics. I could say to my students that they can generate different pedagogies as though mathematical knowledge is abstract, contextual, universal and subjective, which occur in our embodied world (Lakoff & Johnson, 1999).

b) Imagining through multi-schema profiles: Metaphorical logic is about imagining through multiple schema-profiles concepts under consideration. Unlike the conventional logics which are exclusively based on '*what is*' mode of thinking, metaphorical logic can be used for a perspectival thinking and actions that are imbued in broad-based schema-profiles. My idea of schema-profiles can be understood as conceptual landscapes which comprise brushstrokes, fade-outs, gorges, bumps and modulations of concepts under consideration (Adams, Luitel, Afonso, & Taylor, 2008). It appears to me that metaphorical logic is not about correspondence between two (or more) fixed schemas; rather it is about projecting one landscape of schema profiles onto another landscape of schema profiles. For instance, while using the metaphor of teaching as gardening, I make sense of the notion of teaching (a landscape of schema-profiles) by projecting it on to the schema profile of gardening. In so doing, I can project students onto flowers, myself onto the gardener, and the garden onto the classroom. This is an approach to surpassing the narrow boundary of literalism, thereby exploring potential imaginative synergies between contrasting schema-profiles.

How could this feature of metaphorical logic help transform me from a conventional teacher to an imaginative-inclusive teacher? Primarily, by using multiple conceptual schemas, I might be able to liberate my students from the hegemonic thinking that mathematical concepts <u>should</u> always map onto a singular schema. This rather dull approach to meaning generation of mathematical ideas seems to have curtailed students' emerging creativity, thereby discouraging them for creative learning. Secondly, this feature of metaphorical logic could help my students embrace an imaginative attitude rather than an exclusive 'plagiaristic' posture of learning. For me, the plagiaristic posture of learning is largely promoted by the essentialist-literalism embedded in the conventional logics. The third benefit for my teaching of this feature of metaphorical logics is the likelihood of promoting a contextual-imaginative vision of my pedagogy by allowing multiple schemas to interact, thereby helping me to unpack the complexity embedded in my pedagogical enactment. Rather than representing only the apparent meaning of layered pedagogy via some simplistic labels of methods (e.g., teacher/student centred, experimental, lecture, demonstration), metaphorical logic could be useful for conceptualising the complex nature of pedagogical enactment *in situ*. In so doing, I might be able to articulate, embody and perform the multi-profiled pedagogical schemas with clarity, depth, orientation and richness (Geelan & Taylor, 2001). I guess these pedagogical envisionings are equally useful for my role as a transformative teacher educator. One thing I can add here is that while searching for a vision for inclusive-transformative mathematics education, I could encourage students to generate their own images of the view of mathematics, thereby creating a canvas of mosaic imageries and images.

Poetic Logic

Wow! I arrive at a garden with blossoming marigolds, jasmines, roses and rhododendrons. The tranquil environment absorbs me in the ineffable patterns of flower blossoms. With the aim of sculpturing some poetic lines, I check my pockets for a pen and some pages of paper. But my plan of searching for pen-and-paper goes away quickly as I gradually move into a state of deep contemplation. I feel as if I cease my egotistic bodily existence and begin to expand my heart so as to share a deep serenity, love, and compassion with others. I salute these flowers' unassuming posture of welcoming everyone regardless of their disposition, quality and attitude. In the meantime, my eyes capture a much wider path adjoining the garden and leading to somewhere, an unknown place.

(Dream Diary #6)

Section Three

Born to a family that adheres largely to Vedic, Buddhist and Animist beliefs and draws inspiration from hymns, mantra and myths, I can imagine now how poetic

logic helps explore many mystical contours of inner-passionate flames (Denton, 2005a) and outer lives of human selves. For me, poetic logic can be understood as a natural way of interacting self with other through the ever-shifting nature of meanings embedded in different levels of enacting a language. Unlike the logic of extreme assertion, deduction and analysis that often tends to promote a linear, literal and non-relational approach to knowledge generation, poetic logic can help explore the bumpy landscape of human thinking and actions (Danesi, 2004). In Eastern mystical traditions poetic logics-inspired language appears to be a means for communication between different layers of body-souls (Sri Aurobindo, 1972). Contrary to the Western Modern Worldview-inspired idea that knowledge should be presented via assertive language games together with the justificatory logic of deduction and reduction (analysis), Eastern wisdom traditions seem to promote poetic logics-inspired genres as a means for generating and disseminating knowing and knowledge (Mahony, 1998).

As I read a (neglected) history of Western science (sic), my eyes have been captured by the idea of Giambatista Vico, a contemporary of Newton, who appears to be critiquing the ruthless approach to manipulating nature in what has turned out to be the privileged method of the mainstream paradigm of science. Vico's critique of extremely detached rationality, a-priori Platonic reasoning and dried metaphysics helps me understand the usefulness of poetic logic in realising relational rationality, interactive-interpretive thinking and lived experience for my professional lives as a teacher and teacher educator (Vico, 1984). How could poetic logics help me improve my professional life as a teacher and teacher educator? In what follows, I am hoping to use key features of this logic to explore answers to this question.

a) <u>Relationality and connectedness</u>: A poetic logic underlies the notion of relational and connected knowing, being and valuing as a means for generating wisdoms. Unlike the thinking and practice of 'separate knowing' (Clinchy, 1996) that is embedded in the logic of assertion-deduction-analysis, the logic of poetry seems to embed relational and connected landscapes in our thinking and actions. Reflecting upon my role as a conventional teacher, this feature of poetic logics could help promote a relational approach to dealing with different mathematical concepts. Rather than subscribing to an approach to promoting exclusively the assertive-deductive modes of separate knowing, I could promote collaborative, empathic and contextual bases of knowing (James, Kent, & Noss, 1997). Perhaps, the notions of relationality and connectedness could help develop my classroom as a site for cogenerating mathematical knowledge from the personal, social and cultural milieus of students. By considering this feature of poetic logics as a referent for my pedagogy, I could be able to connect between pure and impure mathematics, thereby helping my students to understand the creative multidimensionality of mathematics that I teach.

As a transformative teacher educator, I have embraced some aspects of relational and connected knowing, particularly through cooperative discussion activities. However, I could still promote more fully the idea of relationality as a means for generating possible synergies between different views about mathematics. One important gift that this feature of poetic logics can present to me as a teacher educator is a realisation of multidirectional relationships between perceptions, conceptions, views, postures and perspectives. As it goes with a popular Eastern dictum, a poetic language can organise a marriage ceremony between water and fire, divine and demon, safety and danger, *Brahma* and *Maya*, Buddha and ignorant, and soul and body (Christie, 1979). Couldn't I try to organise a marriage ceremony between pure and impure mathematics, objective and subjective mathematics, abstract and concrete mathematics, and universal and contextual mathematics?

b) Means for expressing ineffability: Exploring this feature of poetic logics reminds me of some aspects of my experiences which could not be accounted for by the conventional logics-inspired prosaic and assertive language games. In wisdom traditions of East, West, North and South, poetic logic-inspired language has been believed to be the language that captures the God-idea emanating from different cultures (Newman, 2003). I am not necessarily saying that this feature of poetic logics has to deal with God or some ethereal power, rather I am arguing for the use of poetic logics as a means for expressing various forms of ineffability rested in our world of thinking, acting and experiencing about pedagogy. In what ways would this feature of poetic logic empower myself as a teacher and a teacher educator? Perhaps, I would benefit in three ways. Firstly, I could use poetic logic to explore my experiential interiority so as to recognise my passions, joys and sorrows accumulated during the process of teaching. In so doing, I would be able to understand my (ineffable) values, thereby acting justifiably in different situations (Taylor et al., 2007). Indeed, it can be this feature of poetic logic that could help me notice many unnoticed events and phenomena. Secondly, through this feature of poetic logic I might be able to share an important message that the knowledge that my students were encountering may not be final. I could also encourage them to explore fully (if possible) the ineffable dimension of their knowing, being and valuing. In so doing

they might be able to see deep connections between ideas, concepts, words and meanings. And, some of these connections might still be a mystery to them and to me. In this way they would be able to embody a depthful and holistic understanding of mathematical concepts, yet recognising uncertainties embedded in claiming to know something. Finally, this feature of poetic logic would encourage me to embrace a posture of humility so as to challenge the longstanding arrogance embedded in extreme forms of assertive prosaic language games (Moore, 2005). Perhaps, it is through this logic that I could gain an enhanced authority as a teacher and teacher educator without being authoritarian.

c) <u>Imaginative, emergent and creative realism</u>: Unlike naïve realism (that promotes a correspondence theory of truth) embedded in the conventional logics, poetic logic seems to uphold the view that reality is a matter of construction through imagination without which we might be producing isolated sounds, buzzes and an assortment of symbols. Can a poetic imagination be ordered, sequential and linear? Perhaps the idea of emergence can best describe the nature of reality embedded in the poetic logics (Faulkner, 2007). Although I cannot claim that everyone views reality in same way, my experience of undertaking this inquiry and other researchers views about reality helps me understand that 'emergence' is a necessary ingredient to access multilayered pedagogical reality. Similarly, it can be through imagination and emergence that creativity is likely to usher in the landscape of mathematics education (Shakotko & Walker, 1999). The etymological root of poetic logics, poiesis, seems to depict the notion of creation, making and production, whereas various Sanskrit words[63] pertaining to poetic logic convey its meanings as association with and creation of higher knowledge.

Considering poetic logic as a referent for my pedagogy, I might be able to open doors to an imaginative approach to mathematics teaching. Through this feature of poetic logic, I could help my students to think of what might be possible, not compactly guarded by the view of the world embedded in naïve realism. By doing so, I could construct my images of being different types of teacher (and students), thereby preparing myself for a poetic approach to embracing pedagogic roles[64] that could transform the hearts and souls of my students. This is equally important for my role as a teacher educator who would like to develop a cohort of teachers who can help transform thousands of students. With the idea that pedagogical reality is emergent, I could embody how conventional assembly-line pedagogical modes are insufficient to account for creative-imaginative dimensions of human soul, spirit, mind and body (Palmer, 2003). Going back to my role as a teacher educator, who wanted -- still wants -- to disrupt the conventional view of *mathematics as a body of pure knowledge*, I realise how this feature of poetic logic could help me to be less presumptive, open and inclusive toward different views of mathematics.

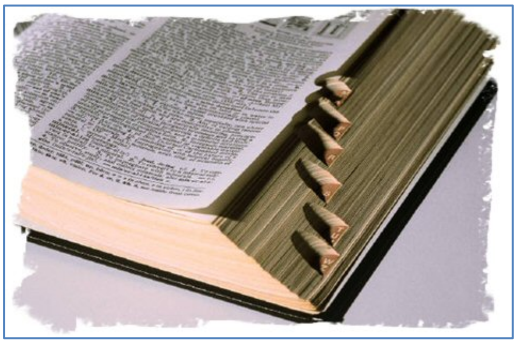
d) Interactive and interpretive nature of language: Unlike the transmissive and transactional nature of language embedded in conventional logic, poetic logic seems to promote an interpretive and interactive nature of language. Vico's idea of reading world from within language as a mirror of social and cultural dispositions and the Vedic idea of finding world in Word seem to indicate the interactive and interpretive

[63] Literature (poetry, fictional writing etc.) (Sahitya: साहित्य) means association, connection , combination , union of self with other; Poet (कवि) means seer, sage, prophet, wise, creator

[64] Multiplistic, associative, collaborative.

nature of language embedded in poetic logics. Perhaps Vico was critiquing the exclusive literal-assertive and non-porous nature of language sprouting through the worldview being generated via Cartesian-Newtonian language games (Fleener, 2005; Fleener et al., 2004). Poetic logics embedded in various Vedic texts seem to have conceived language as a means for cultivating various dimensions of being (Sri Aurobindo, 1970). Indeed, poetic logics can liberate our pedagogical language (or languaging) from the duality of *langue* and *parole*, thereby preparing me (and us) for a space in which to identify the porous nature of language (Jardine, 2005). Here, the notion of porous nature indicates bumps, gorges and brushstrokes embedded in our sounds, words and sentences.

As a mathematics teacher, poetic logics could show an aesthetically textured landscape created by the interpretive nature of language embedded in it. By refraining from using the exclusive view of mathematical language as an objective entity (similar to a tangible object) in an endeavour to facilitate a non/objective (soulful, contextual, playful, multiplistic, context-dependent-unique) view of reality, I could use my inner poetic (creative, imaginative, dreamful) voice for creating a caring pedagogical space that could promote an inclusive approach to mathematics teaching. Does this mean that I was not a caring teacher? Personally, I might have been a 'normal teacher' who taught mathematics as per the conventional image of *curriculum as subject matter*. Perhaps, such a normalcy could have impeded my subconsciously situated zeal of becoming a creative teacher, a teacher who strives to generate unique, synergetic and magical ideas for making mathematics meaningful. And, my becoming as a normal teacher might have been facilitated (or restrained) by the hegemonic logics of assertion, deduction and analysis, for which language is merely a pre-fixed meaning container.



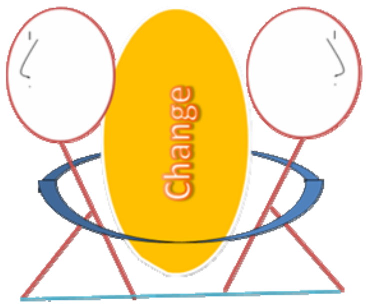
As a teacher educator, I could benefit from this feature of poetic logic at least in four ways. Firstly, I could be vigilant about the language that I am using. Perhaps my overly emphasised philosophical language could not help account for the soulful and fluid nature of reality that could be well represented by poetic logics-inspired languages. Secondly, poetic logic could help me realise how it is futile to speak with absolute certainty without knowing what happens next! Does this mean that I should not speak about anything? How can I communicate then? My emphasis here is not on stopping my voice; rather my focus is about embodying uncertainties in my pedagogical languages. Thirdly, it could be poetic logics-embedded language that might help me in bringing musicality, aesthetics, emotions and contours of inner and outer experiences to my classroom activities, thereby promoting interactive and interpretive language games (Gerofsky & Goble, 2007). Last but not least, a poetic logics-inspired language could help me be minimally presumptive and judgemental, thereby expanding my boundaries of heart and mind beyond the 'a priori' nature of philosophical understanding. Nevertheless, I am not trying to say that philosophical understanding is not important; rather I am critical of the exclusive mapping of 'generic grandiosity' onto my (and my students) unique lived experiences.

Dialectical Logic

I am walking out of the garden with a tremendous hope, will power and energy. I feel now that I can respond to any beastly, demonic and devilish forces with a peaceful, angelic and friendly posture. Whilst I keep on strengthening this positive spirit, my previous construction of demonic, beastly and devilish images appears to be transforming into an holistic montage of images that I have been encountering so far. My consciousness gradually expands beyond my mundane imagination, thereby blurring the longstanding demarcation between mind, body, heart and soul.

(Dream Diary #7)

Although I have discussed various forms of dialectics in Section One, this re-enactment sheds light on dialectical logics in the context of generating inclusive and transformative visions of mathematics pedagogy. For me, dialectical logics are the logics of synergy in which different (often antagonistic) qualities, objects and conceptualities are held together (Giegerich et al., 2005; Wong, 2006). Contrary to the *old* logics' approach to promoting a dualistic worldview, various forms of dialectical logics seem to promote integrative, holistic and inclusive worldviews arising from the notion that antagonisms are inherently inseparable and co-arising (see Section One). Speaking



from my lived experience, dialectical logics are useful for making sense of our day-to-day realities which comprise antagonisms and contradictions. Drawing my life-values from humanist aspects of Hindu, Buddhist and other Wisdom Traditions of East and West, I find how it is naïve to account for one aspect of conceptuality whilst discarding its potentially opposing aspects. As I talk about the antagonistic and contradictory nature of reality, can it also be interpreted that dialectical logics are all about striking a balance between antagonisms and opposites? Perhaps, the notion of 'striking a balance' connotes a static view of reality, which does not fit well with the transformative potential embedded in various forms of dialectics (see Section One). With this notion of dialectical logics in mind, let me take a brief detour to explore key features of dialectical logic that could help develop inclusive and transformative pedagogies for my professional context.

a) Synthesis, inclusion and synergy: By this feature of dialectical logics, I could be able to generate a synergy between 'pure' and 'impure' mathematics (see Section One). As a teacher, by incorporating different forms of impure mathematics in my enacted (i.e., day-to-day, implemented) curriculum, I could (at least) embody a two-dimensional approach to mathematics knowing (Skovsmose, 2005)[65]. Although it was impossible for me as a teacher to alter the entire curriculum, there could be a number of possibilities for creating synergies between the algorithmic and narrative, literal and metaphorical, and universal and contextual natures of mathematical knowledge. In the context of mathematics education, dialectical logics can be a pragmatic tool for correcting the problem being exclusive of local cultural practices of people for whom mathematics education has been intended. Retrospectively speaking, I, as a teacher, could act at the classroom level (and potentially at the school level) to create an inclusive and synergistic approach to dealing with different forms of mathematical knowledge brought by students to the classroom. For instance, my students were from different social and cultural groups in terms of their ethnicity, culture and parents' occupation. I could invite them to explore how some mathematical concepts, such as equations, profit and loss, triangles and quadrilaterals are being used in their and their parents' day-to-day practices (Kathmandu University, 2008). In this way, students would likely to feel included in terms of their contribution to knowledge generation. Perhaps, the next step would be to create synergies between their lived mathematics and mathematics embedded in the textbook. What could that synergy be? Perhaps, it would be their multilayered and multi-profiled understandings about mathematical concepts. As a teacher educator, dialectical logics could help overcome unhelpful dualisms embedded in my thinking and practice and enable me to embody an inclusive

[65] Ole Skovsmose talks about two dimensional nature of dialectical thinking which can bring informal and formal mathematics to the classroom.

pedagogic vision for incorporating different images representing the multidimensional nature of *mathematics as an im/pure body of knowledge* (see Section One).

b) Non-duality: Different forms of dialectical logic from the East and West (maybe also from the North and South) seem to have a common view of reality as unseparated between subject and object, known and knower, and self and other. In the initial stage of this inquiry, these ideas challenged my un/conscious assumption about knowing, being and valuing as exclusively separate entities. Re-excavating[66] my cultural, professional and personal narratives as well as going through others' texts about dialectical logics have led me to the view that holding an extreme form of dualistic perspective is akin to claiming to have known an entire body by examining a certain organ. Relating this feature of dialectical logics to my role as a teacher, I could have transformed my role from a knowledge dispenser to a knowledge sharer. In so doing, I might have been able to bridge the unnecessary gap between teacher and students. Similarly, I could minimise the Platonist view of *mathematics as unchangeable Forms* by making a bridge between worlds and words of mathematics. What type of bridge would that be? How could such a bridge reduce the exclusive form of dualism embedded in Platonist thinking? Perhaps, constructing such a bridge could entail a process of renunciation of various status quos. In retrospection, I needed to suspend the conventional logics-inspired authoritarian pedagogy whereby my students might relinquish aspects of their passivity. Drawing both of us close to a *thirdspace* (see Section Two) would be helpful in reducing the border.

How could this feature of dialectical logics be useful for my role as a teacher educator? Rather than interpreting categories, such as pure and impure, universal and contextual, and impermanent and permanent as nonnegotiable, I could regard these categories as part of the ever-changing impermanent world. How

[66] My first excavation has taken place drawing an autoethnography (Luitel, 2003) for exploring my lived experiences as a student, teacher and teacher educator. See its summary in Section Zero.

could I take these impermanent categories as permanent? Beside this, the notion of non/duality (see Section Two) could play an important role for maximising the participation of my participants in planning and implementing the curriculum of the unit (i.e., Mathematics Education) that I was teaching. Perhaps, I could have suspended my extreme capital p Philosophising approach, thereby inviting them to share their own narratives. In this way, they could directly experience a non/dual pedagogical space in which they might participate actively in co-creating knowledge.

c) Eco-pedagogical imagination: As I begin to explore this feature of dialectical logics, an imagery of unbounded, green and multiplex pedagogical landscape appears in my mind's eye. Choosing these imageries is likely to facilitate me to imagine the pedagogical world as relational, meaning that one attribute of conceptuality helps make sense of another attribute. Furthermore, the idea of ecological imagination helps cultivate a relational view of reality, thereby promoting the co-existence of varying aspects of knowing, being and valuing that are embedded in my pedagogical practices. Thus, the idea of ecological imagination is to cultivate a what-might-be-possible vision via various forms of relationships (antagonistic, complementary, binary, synergistic, facilitative, connective, causal, iterative, textural, emergent) (Basseches, 2005; Hampson, 2007) existing in my pedagogical landscape.

In what ways can this feature of dialectical logics transform my pedagogical practices as exclusively a subject-centred teacher to an inclusive world-centred teacher? My label of subject-centred teacher can be equated loosely with the notion of transmissionist teacher who seems to promote a compartmentalised view of mathematical knowledge and pedagogy. On the contrary, a world-centred teacher is keen on making connections of mathematical ideas with the world outside the school, thereby offering an ecological view of reality, which puts emphasis on multiplicity, synergy and relationality in making sense of the world around us (Wilber, 2000a). By striving to be a world-centric teacher, I could emphasise connecting mathematical concepts and ideas with students' lifeworlds. Next, I could encourage students through collaborative activities to search for mathematical knowledge in their local cultural contexts. In such activities, students may encounter contradictions between the *formal* mathematics that has a canonical classificatory system and informal/local mathematics that might work through a contingent classificatory system (Luitel & Taylor, 2007). Learning through two knowledge systems might help generate a synergistic and relational view of mathematical concepts, at times helping my students to engage in moral imagination about creating a harmonious and justifiable world that constitutes various adversaries, complementaries and other forms of relationships.

As a teacher educator, the notion of an eco-pedagogical imagination could help me cultivate possibilities for generating an inclusive vision of mathematics education through an eco<u>logical</u> framework which promotes notions of togetherness, empathy and collective imagination. As the etymological meaning of ecology is rooted in a dialectical relationship between *house* (oikos) and individuals residing in it, I consider the term 'house' to be a metaphor of cultural and professional situatedness (Bowers, 2003). Taking on board this feature of dialectical logics, I could begin with our own *house* (our cultural, professional narratives), thereby generating a collective commitment to preserving, enriching, refining and saving its uniqueness. In this process, 'capital p' Philosophical ideas arising from Social Construct(iv/ion)ism, Critical Theory and Ethnomathematics would be considered as complementary (or supplementary) referents for our pedagogical imagination whilst establishing the primacy of our own local narratives over other grand-narratives embedded in different philosophical traditions.

Narrative Logic

Upon my arrival at an open and wide area, the humanlike image re-appears and moves close to me. It seems to me that the image wants to say something. An utterance of some vague words passes through my ears. I don't feel that I need to ask *him/her for a clarification any more. Slowly, his/her sounds begin to emanate from the outside and inside of my consciousness, for there does not appear to be a clear separation between in and out. I find such a phenomenon of blurring borders easily comprehensible as there is no sense of incomprehensibility. As I move further, my 'perceptions' unite with 'conceptions'. Perhaps as a result of this, the humanlike image and my body unite together, thereby offering a serene experience of vastness, inexhaustibleness, unboundedness and sacredness.*

(Dream Diary #8)

Unlike the selfless text that is promoted by the exclusive form of conventional logics, narrative logic seems to promote the text embedded in my 'self' (and selves) playing various roles, from teacher educator to active citizen (Walshaw, 2009). In the North American history of qualitative research, narrative logics-inspired texts seem to have arisen after the poststructural movement that made visible the intertwined relationships between text and textuality (Denzin & Lincoln, 2000). Known as the 'crisis of representation', this movement in social research questions the privilege assumed by any form of text as being the unquestionable genre for representing knowledge claims, thereby creating the ground for personal, embodied, soulful, contextual and reflective genres to depict knowledge claims. Despite this relatively very young history of narrative-logics inspired texts in social research, narrative logics appear to have been enriching human lives since time immemorial through story, myths, parables, paintings, theatrical representation and performances (Baldwin, 2006; Clough, 2002). For me, intentional use of narrative logic could help transform my pedagogical landscape from selfless contours of assertive, deductive and analytical logics to an embodied telling, re-telling and restructuring my pedagogical enactment. Given this notion, I am about to explore some key features of narrative logics bringing forth my experience as a mathematics teacher and a teacher educator.

<u>a) Activity as expression of meaning</u>: With this feature of narrative logics, my role as a teacher could transform me from embracing the conventional logics-inspired notion of the meaning of mathematics as fixed and unchangeable to the view of meaning as

dependent upon its enactment. The idea that meaning is contained in algorithm and unchangeable mathematical definitions could be complemented by the view that meaning is generated through activities *in situ*. With the help of this feature of narrative logics, my students could be involved in creating their own personal and cultural stories about using equations, angles and other mathematical ideas. If I was consciously embodying this feature of narrative logics, I would be developing various activities that would help generate contextual meanings of mathematics through stories, parables and theatrical representations. As a teacher educator this feature of narrative logics would allow me to use the notion of 'activity' from two perspectives. Firstly, I could use stories generated via cultural activities of people so as to explore the contextual and culturally embedded feature of mathematical knowledge. In so doing, I might also be expanding the meaning of mathematics education as a promoter of assertive-deductive-analytical reasoning to an inclusive knowledge system that accounts for activities performed by farmers, villagers and tradespersons. Needless to say, my students' narratives as teachers would also be helpful in cultivating an embodied and cultural meaning of mathematics education. Secondly, the idea of activity could be used to design my pedagogy for the unit,

Mathematics Education, in creative and constructive ways. What does creative and constructive ways entail? I could pay equal attention to the play and display of meaning through my pedagogical actions (Polkinghorne, 1995, 1988). In this process, my pedagogical texture could infuse actions, ideas and perceptions as a cornerstone of our (my students' and my) meaning making of inclusive views of mathematics education.

<u>b) Lived reality:</u> Contrary to an excessive emphasis on searching for reality outside of one's own life, narrative logics seem to act from within and from the proximity of human lives. As a teacher, I could buy into and act through the idea that life experiences are the best possible means for making sense of the mathematics that I was teaching. Rather than focusing on an exclusively decontextualised view of mathematical knowledge, I could make use of reality lived by people as a means for making sense of mathematical concepts, definitions and ideas. Perhaps it is through this view of reality that I could include different types of mathematical knowledge

coalesced through narrative logics-inspired language. Maybe a metaphor of weaving can be helpful here to depict my meaning of lived reality which can offer a non/dualistic site for enacting my pedagogical perspectives in context (Greene, 1985). As a teacher educator, the notion of lived reality could offer me a host of perspectives so as to enact my pedagogy meaningfully. With the perspective that life, meanings and texts are pedagogical tools, I could maximise the use of experiential narratives as a means for enacting inclusive views of mathematics education. Similarly, the idea of lived reality could help identify the nature of lifeworlds which I was intending to. How could I teach effectively about an inclusive view of mathematics education without being inclusive of the lived experiences of my students?

c) Contingent and contextual truths: One of the moral bases for promoting contingent, connected and contextual truths in my teaching is that such truths allow students to think creatively and constructively rather than embracing an exclusively dogmatic view of *mathematics as a pure, indubitable and certain knowledge system*. Furthermore, it might be through this feature of narrative logics that an inclusive view of mathematical knowledge and knowing makes a significant impact in the field of mathematics education by helping students see contingent but useful forms of mathematics interacting in their lifeworlds. Does this mean that narrative logics do not value universal and objective truths? Rather than speaking from yet another dualistic standpoint (see Section Two), I hold the non/dual view that the notion of contingency and contextualism are aspects of an holistic truth. My purpose in highlighting this feature of narrative logics is to strike a dynamic balance between the widespread views of time-, culture- and space-free mathematics and the contingent nature of knowledge and knowing. As a teacher educator this feature of narrative logics could help reconceptualise my pedagogy via the lens of cultural imagination (Baldwin, 2006)[67]. The idea of cultural imagination might be highly dependent upon local narratives as a means for searching for answers to these questions: What is possible? How can it be? Where might it lead to? When is it likely to happen? These answers are likely to constitute a great deal of contingent and contextual truths so as to explore diverse pedagogical pathways that are likely to enrich my students' lives as teachers. In this process, I could use aspects of connected knowing as a means for cultivating a culturally imagined pedagogy. The notion of connected knowing helps uphold empathic relationships between knowers, text and context, and self and others. What type of curriculum vision can help promote such a vision of knowing? Hopefully, this question will orient my next journey of inquiry.

Recapitulating the Present, Mapping the Futures

With the chief purpose of investigating key features of propositional, deductive and analytical logics (i.e., old logics), I started the journey of inquiry through my lived experiences as a teacher and teacher educator. Articulating the meanings of propositional logic as emphasis on literalism through declarative statements, deductive logic as a tendency to privilege law-like ideas over contextual particularities, and analytical logic as an approach to promoting binary opposites, I unpacked four key features of these logics: hegemonic control, disembodied knowing, disempowering essentialism, and a narrow view of rationality.

Unpacking hegemonic implications of *old* logics for mathematics education in Nepal, I proposed four *new* logics as an additional (together with old logics) orienting basis for pedagogies of an inclusive mathematics education. Concepts of embodied realism, emergence, non/duality and eco-pedagogical imagination were considered to be some of the key features of *new* logics. By elaborating their features, I envisaged a number of empowering implications for inclusive mathematics pedagogies, such as an emphasis on synergy, multiple ways of knowing, ecological sensibilities, and including the lived realities of learners in mathematics pedagogies, to name a few.

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[67] Cultural imagination takes into account many seen and unseen activities of and relationships between actors so as to imagine possible actions and meanings in a particular context.

In Section Five of this thesis, I shall explore further how the reductionist image of *mathematics curriculum as an object or a thing* together with the disempowering notion of reality as stable equilibrium prevents us from conceiving an inclusive mathematics education. In this process of inquiry, I hope to use the concept of *old* logics to investigate the nature of thinking that orients an exclusively decontextualised model (i.e., rationalistic model) of designing and implementing the mathematics curriculum. Consequently, I aim to employ aspects of *new* logics for conceiving an inclusive vision of mathematics curriculum in Nepal. Similarly, Section Six will demonstrate how dialectical logic can be used for envisioning an inclusive mathematics teacher education that incorporates knowledge systems arising from the lifeworlds of local people.

SECTION FIVE: A CURRICULUM VISION FOR INCLUSIVE MATHEMATICS EDUCATION

Orientation

In Section Zero of this thesis, my autobiographical impulses gave rise to a number of research issues including the image of *mathematics curriculum as an object or a thing* being a key aspect of the culturally decontextualised mathematics education of Nepal. Whilst writing Section One, I realised the need for envisioning a transformative curriculum vision that is compatible with the multidimensional and inclusive nature of *mathematics as an im/pure knowledge system*. In my inquiry into pedagogies guided by the thirdspace and dissolution metaphors (see Section Two), I referred to this still embryonic section with a view to envisioning a transformative mathematics curriculum as a basis for implementing such pedagogic perspectives. More so, Section Three, which reported my inquiry into the phenomenon of various forms of reductionism, made a case for formulating a transformative curriculum vision that can help pacify ruthless reductionism prevailing in the field of mathematics education in Nepal. More so, Section Four gave rise to the important research theme: the facilitative role of new logics in conceiving a mathematics curriculum vision of inclusivity. Given the intertextual relationships between this section and previous sections of my thesis, the following three research questions now lead me to further my inquiry into various aspects of the mathematics curriculum of Nepal:

- In what ways is the mathematics curriculum of Nepal guided by the disempowering notion of a narrowly conceived modernity? What are its underlying assumptions about the nature of reality, knowledge and knowing, language and thinking, and culture? In what ways may those assumptions not be helpful for conceiving an inclusive mathematics education?

- How can curriculum workers (like myself) act inclusively to transform the modernist-inspired exclusionary practices of designing and implementing the mathematics curriculum in Nepal?
- In what ways can I develop a transformative curriculum vision for mathematics education that is inclusive of sometimes opposing knowledge systems, perspectives and ideologies?

With these research questions at my disposal, my inquiry in this section proceeds with four key objectives. First, I aim to elaborate exclusionary views embedded in the modernity-inspired curriculum models (i.e., rationalist curriculum model). The second objective of my inquiry is to explore the extent to which such models are unhelpful for conceiving an agentic and inclusive vision of mathematics education in Nepal. Third, I intend to reflect critically upon my recent involvement in revising the school mathematics curriculum in relation to competing assumptions of modernist and non-modernist views of curriculum. Last but not least, I hope to articulate a transformative image of *curriculum as montage* that incorporates various curriculum images and that can follow the inclusive spirit of the multidimensional nature of mathematics as an im/pure knowledge system.

In this section, I have used narrative imagination together with some aspects of performative imagination[68] so as to critique the exclusive view of curriculum as a thing (a combination of images of *curriculum as subject matter* and *discrete tasks and concepts*) rather than a socio-cultural construction of practitioners (Grundy, 1987), and I propose a transformative curriculum vision to promote meaningful, agentic and futuristic pedagogies in mathematics education. Subscribing to moral and political standpoints as a basis for envisioning better futures (Lather, 2008), this section does so by unpacking my commitments to social justice, equity and inclusion in mathematics education by means of a nascent curriculum vision. In doing so, my research text challenges the hegemonic normalcy that perpetuates in designing and implementing the mathematics curriculum of Nepal, thereby paving the way for

[68] Written in the narrative genre (letter writing), readers of my thesis can perform ‘letters’ as theatrical texts.

envisioning empowering curriculum visions that provide teachers and students with a basis for lifeworlds-oriented, meaningful and relevant mathematics education (Gutstein, 2007; Luitel & Taylor, 2005, Apr).

The three Chapters of this Section are presented in the form of letter writing between me and a 'composite character' (Taylor, 2002), Curriculum Officer. This composite character comprises attitudes, postures, perspectives and working styles of more than one officer working in the Curriculum Planning Office[69]. Situated within my professional experience of the year 2005, the first chapter (i.e., Chapter 11: Unpacking the Trivia of Exclusive Modernist Curriculum Practices) unpacks and critiques through two semi-fictive letters key orienting features and assumptions of the mathematics curriculum that promotes exclusion and elitism in mathematics education. The second chapter (i.e., Chapter 12: Appraising My Role as a Curriculum Committee Member: Making Sense of Situatedness) critiques and appraises my role as a curriculum committee member through an exchange of semi-fictive letters between me and the character, Curriculum Officer. Building on our previous exchanges, the final chapter (Chapter 13: Constructing a Transformative Curriculum Vision: Pluralism, Synergy and Montage) embodies a transformative curriculum vision. Conventionally speaking, the semi-fictive letters written by the Curriculum Officer character can be regarded as data and my responses to them as interpretive texts. However, this point of view is not sufficient insofar as data texts and interpretive texts form interactive, blurring and reflexive relationships. I have included boxed poems and images, where appropriate, to evoke readers' pedagogical thoughtfulness (van Manen, 1991).

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[69] Pseudonym of a government office under the Ministry of Education, Nepal

CHAPTER 11: UNPACKING THE TRIVIA OF EXCLUSIVE 'MODERNIST' CURRICULUM PRACTICES

I Want Proof, Can You Give Me One?

July 2008

Curriculum Planning Office

Block D, Indranagar

Kathmandu Nepal

Dear Bal Chandra

I am writing this letter to share some of my confusions related to the notion of curriculum that you presented in the month of July, 2005 at the University of Himalaya. Perhaps, you remember me well that after your presentation we chatted for a while and I gave you the letter issued by the Curriculum Planning Office informing of your nomination to the Essential Mathematics[70] *Curriculum Committee of Optional Mathematics. We promised to sit one day and have discussions about my confusions, but we could not really work how out to address these confusions. We even planned to have one-to-one discussions with a view to reviewing our roles in the Curriculum Committee meetings. But we could not make this either. After two years, I am trying to explain my confusions by reconstructing my memories of your talk entitled, What Is Wrong With The Existing Mathematics Curriculum of Nepal. I am hoping that you will generously respond to my concerns and confusions that I am going to mention in this letter.*

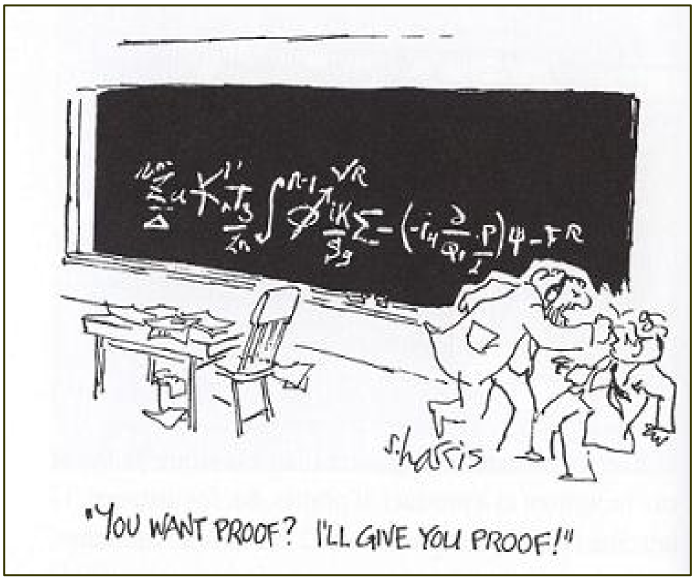
In the first part of the talk, you blamed the mathematics curriculum for being exclusively guided by the Newtonian worldview, which disregards cultural

[70] Pseudonym

ecological knowledge and posits man as an agent for exploiting Nature. Your major point was that our curriculum planning and implementing mechanisms unwittingly privilege the theoretical lens of the Newtonian worldview as a given, thereby rendering other possible lenses the deviants and inaccurate explanations of the world around us. You gave some examples that the Einsteinian notion of relativity would be more appropriate than the Newtonian view which regards reality as unchangeable, inert and in a state of stable equilibrium. I begin to see some truths in your articulation. However, I am not sure about ways in which the Newtonian view of reality is not helpful for developing an inclusive mathematics education. My conventional self tells me that your ideas are very much idealistic and can hardly be implemented in a real sense, especially in the context of Nepal. On the other hand, my reform-minded self suggests that I, as a curriculum worker, need to be informed about multiple perspectives on curriculum development. Perhaps, this inner conflict in me insists that I raise this question with you: Why can the Newtonian view of reality not serve an orienting perspective for developing the mathematics curriculum of Nepal, even though this view appears to be quite obvious, conceivable and simple?

Dear Bal Chandra, I remember that three of the participants of your talk program were pretty vocal when you became hypercritical about the knowledge production system legitimated by the mathematics curriculum. Mainly, you were critical of the existing curriculum because of its emphasis on not valuing teachers' and students' soulful, contextual, subjective and informal mathematical knowledge. Do you remember that one participant representing a university department was very angry as you claimed that school mathematics serves a neo-colonial agenda by privileging one particular form of knowledge system whilst suppressing other contextual knowledge systems? It was also shocking for me as you downplayed the type of knowledge included in the existing mathematics curriculum. Whilst responding to the question of a postgraduate student, "Are you suggesting that we be dismissive of Modernist Mathematics whilst incorporating a narrowly conceived cultural nature of mathematics into the curriculum?, you seemed to favour the inclusion of different types of mathematical knowledge systems in the mathematics curriculum. As you kept on responding to a number of questions, I begin to ask myself: Why does Bal Chandra experience problems with the objective, infallible knowledge system of mathematics? Why does he not see them as unique strengths?

You kept on cruising further into the sea of critical perspectives, assaulting what you called a reproductionist and mimetic culture being promoted via mathematics curricula. Initially, I felt that it was a very embarrassing day for some mathematics teachers who were in the audience, as you exposed different forms of tyranny practised by teachers in their pedagogical practice. When you said that teachers are local authorities in the hierarchy of tyrants for reproducing the disempowering culture of pure mathematics (you labelled abstract, algorithmic, symbolic and formal mathematics as 'pure'), I was reminding myself of the mathematics teachers who I have conversed with recently. They were of the view that better learning in mathematics is only possible by creating a strict environment where students are only permitted to follow the teacher. Next, you embarrassed me by saying that Curriculum Officers and experts can be considered as another group of tyrants because they are interested in imposing their ideas on teachers and students. At this point, I was in a resisting mood, not in the mode of reflection. As I looked around, all participants had gloomy faces apart from some mathematics professors who were cultivating joy out of others' embarrassment. But that joy could not survive long enough. You fired a salvo of critique toward mathematics professors: They can be regarded as the key promoters of cultural reproduction in mathematics. As you were explaining why mathematics professors are the chief tyrants in the educational hierarchy, your PowerPoint slide showed a satirical (adjoining) cartoon about a mathematics professor kicking out a sceptic. Everyone in the audience was angry until you said, "I also have a share in this perpetual tyranny. I had taught mathematics in a very conventional way. But, these days I try not to be so." I buy into your idea of cultural hegemony and tyranny as a good theory. In my experience, developing a curriculum has been an act of bullying (as is teaching and assessing), a method often used by tyrants and oppressors. I am not yet sure if your critique of culture could offer



something useful. Please, write clearly why culture has been a major issue of critique in the culture free subject (i.e., mathematics). I am expecting you to clarify the notion of cultural reproduction and hegemony of Modernist Mathematics.

I have to say sorry that I keep on asking you so many questions. Do you find my letter engaging? I am going to wrap up my letter after asking some clarification of your critiques of disempowering communicative approaches that are promoted by the mathematics curriculum of Nepal. Toward the final part of your presentation, you pinpointed the disempowering communicative practices embedded in mathematics education. And, you further claimed that the mathematics curriculum of Nepal is a key to promoting such communicative practices. One of the participants in the program challenged you in this way: "Are you saying that we should always use nice and polite forms of language?" You responded to this by critiquing the existing 'language' (used in classroom and curriculum committee meetings) that is privileged by the mathematics curriculum because it is not committed to dialogue, empathetic knowing and meaningful learning. You further said that being nice, smiley and lovely can certainly bring some positive changes but the point here is that the language promoted through the existing mathematics curriculum is not helpful of inclusive, invitational and open discourse.

Dear Bal Chandra, this is how I have perceived your talk about curriculum. Please forgive me if my questions and concerns bother you. In raising these questions I have been thinking about ways to improve our mathematics education inasmuch as my position as a Curriculum Officer allows me to do so. Don't you think we need to act within various forms of constraints? Finally, I would like to thank you for reading my letter and will be waiting your responses to my questions.

Sincerely yours

Curriculum Officer

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Section Five

August 2008

10023 Far Out Street

Mother Goddess Town

Dear Curriculum Officer

Thank you for your inquisitive letter. It is a very pleasant beginning toward creating a dialogic space for articulating our questions, comments and perspectives. Although I have incorporated many new perspectives recently in my thinking, the issues, concerns and questions that you have raised are still prominent if we are to fully realise inclusive visions of curriculum. If I were to give a talk on the same topic now, I would be addressing the issues slightly differently. These days I pay extra attention to inclusive and non/dualistic[71] language, thereby emphasising an empathic communicative relationships with participants (Arnold, 2005). Perhaps, this is how I am transforming my earlier dualistic curricular practices to a non/dualistic (inclusive) one. Here my notion of non/dualism is an approach to embracing dialectical thinking so as to overcome exclusive views about anything, including curriculum. In this process of articulating a non/dualistic and inclusive vision, we may need, if you want, to exchange a couple of letters that include critical analysis of the exclusive view of curriculum as a thing or object[72], thereby proposing inclusive visions and perspectives. Having set to generate a dialogic space (Dunlop, 1999), in this letter I am going to unpack a number of assumptions behind the elitist mathematics curriculum that prevent mathematics education from being a meaning-making enterprise. I hope I am able to respond to your comments and questions that you have raised in the letter.

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[71] I have used ‘/’ to represent a dialectical relationship between sometimes opposing concepts, labels and phenomena.

[72] I have used the notion of curriculum as an object or thing as a combination of two key conventional curriculum images, *curriculum as subject matter* and *as discrete tasks and concepts*.

I will be starting the main text of the letter with a critical take on the equilibrium view of reality (Davis, 2008) that orients the mathematics curriculum of Nepal. Responding to your concerns about my notion of bureaucratic language, I am trying to expand key features of Western Modern Worldview[73] - inspired language and thinking that prevents the mathematics curriculum being inclusive of culturally situated thinking and expressions. Here, my notion of 'language type' is not limited to language as a medium of instruction; rather it enables me to use the metaphor of *language as constitutive of lifeworlds and worldviews* (Gutiérrez et al., 1999). In so doing, I am also looking into types of thinking (logics) that orient the mathematics curriculum of Nepal. In this process of writing, I am going to delve into the type knowledge and knowing being promulgated by the mathematics curriculum. Perhaps, this will clarify ways in which the existing mathematics curriculum is prone to emphasising exclusively decontextualised knowledge. Finally, I am unpacking key features of hegemonic culture being reproduced by the mathematics education of Nepal. I argue here that the exclusive image of *curriculum as subject matter* and *discrete tasks and concepts* coupled with transmissionist pedagogy play a vital role in reproducing such a culture.

Aspiration

I want to move from here
But you blocked me, my dear
You said: don't go to the edge
You can come under siege

I cannot stay here forever
My body numbs and loses its senses
I cannot see the far-flung horizon
Look, I begin to forget my mission

I cannot sustain in a bounded space
How do I learn how to face?
If I am not allowed many to-and-fros
How can I realise needs for change?

My eyes want to see colourful flowers
My mind is longing for dreams
My hands search for different touches
My feet aspire to walk away from the freezes

Thus free me from these restrictions
Liberate me from not having visions
Let me sight moving facets of reality
Let me energise my being via multiplicity

[73] The Western Modern Worldview is a culminating worldview of the combination of a Newtonian mechanistic view of reality, formalistic thinking of science and mathematics, a Platonic vision of knowledge and knowing.

Encountering the Equilibrium View of Reality

Dear Curriculum Officer, I am going to start this part of the letter with these questions of yours: What do I mean by the equilibrium view of reality? In what ways can an exclusive use of this view of reality be disempowering whilst designing and implementing the mathematics curriculum of Nepal? Please be aware that my present response is somewhat different from how I would be responding to participants during my talk in 2005. At that time, I was using a postmodern (and Einsteinian (?)) view of science whereas in recent years I have added complexity science and Integralism to facilitate my thinking and actions.

You may agree with me that the notion of the equilibrium view of reality is attributed to Newton who appears to have conceived a stable view of reality in the process of constructing many scientific laws, including the Laws of Motion which assume the 'state of natural rest' as the given condition. In my reading of Prigogine's (2003) book, *Is Future Given,* the Newtonian view of reality (the Scientific basis for the Western Modern Worldview) is guided by a notion of equilibrium in which the phenomenon of entropy (a measure of disorder) is left out because of the prevailing reductionism in articulating phenomena, events and conceptions. I argue here that the mathematics curriculum of Nepal is guided by a similar assumption that 'entropy' is a notion to be eliminated with the help of rationalistic models of curriculum development. Here, rationality is considered to be a key tool for bringing orderliness to those models, thereby accounting for those knowledge systems which have high fidelity to the Western Modern Worldview. A particular characteristic of such a curriculum is the dominant image of *curriculum as subject matter* that privileges a particular set of logics loyal to the Western Modern Worldview. I will return to the issue of logics under the heading of language and thinking of this letter. Thus, an exclusive emphasis on the *image of curriculum as*

The Western Modern Worldview at a glance (adapted from Coates, Gray, & Hetherington, 2006; Schech & Haggis, 2000; Taylor & Wallace, 2007)	
Knowledge and knowing	Decontextualised, abstract, impersonal, hierarchical, probing-oriented, piecemeal
Values	Amoral, loss of community
Reality	Equilibrium and presence
Logics	Analytical, deductive and propositional
Language/ representation	Prosaic, seamless text, impersonal, outgoing

subject matter (or an externally prepared document) results in the interpretation of curriculum as an unnatural constituent imposed from the outside of school settings. Reflecting upon my experience as a high school student, I remember my mathematics teachers complaining about the anomaly between the curriculum and the reality in which to implement the curriculum. Next, in my role as a teacher trainer in 1998-2001, many mathematics teachers shared their dissatisfaction with me about the introduction of some additional subject matter whilst dubbing it a major curriculum change. As I remember now, three major concerns posed by teachers were: (i) the change (?) in curriculum does not account for the reality of school contexts, and (ii) the process of curriculum change is akin to exclusive an imposition of the ideas of experts without paying much attention to context-specificity.

Really?

How can you use your own voice?
How can you go beyond defined research device?
This is research. You are doing science.
Don’t ever try to go away from the framework.

Research is all about probing variables
‘Handful of them controls the whole system’
This is the mantra. Attach this with data sheets
Avoid feelings as you play with numbers

Words are fuzzy and sentences are clumsy
Use numbers and equations for clarity
Avoid metaphors, similes and stanzas
Cut and dried should be your language

Dear Curriculum Officer, I argue that the equilibrium view of reality is translated into the discourse of curriculum through the privilege of *presence* (Derrida, 1993). In my mind the notion of presence entails that which is already present in the consciousness of experts, curriculum officers and teachers. For instance, the ‘presence’ of a uni-dimensional nature of *mathematics as a body of pure knowledge* is incontestable (Section 1). Why? Why don’t you think about views of the nature of mathematics other than *mathematics as a body of pure knowledge*? You may agree with me that heretical views of the nature of mathematics, such as *mathematics as impure knowledge*, *mathematics as a multi-perspectival discourse* and *mathematics as fallible knowledge*, remain ‘absent’ (as opposed to present) from the discourse of curriculum design. I believe that it is because of many unhelpful dualisms promoted by the Western Modern Worldview (Section 2, 3 and 7) that privileges *presence* over *absence*. However, I do not hold yet another exclusive view that the Western Modern Worldview should totally be dismissed and replaced by other worldviews, rather I am critical of its hegemony that does not help it be inclusive, synergistic and transformative.

In my mind another feature of the equilibrium view of reality is an exclusive emphasis on the atemporality of knowledge that is embedded in the mathematics curriculum (Doll, 1993). Don't you agree that the notion of atemporality might have prevented mathematics teachers (and you) from conceiving of curriculum from perspectives other than curriculum as a thing (subject matter, document and unchanging text)? Please, consider this view of mine as well: *the notion of atemporality orients the mathematics curriculum to prevent the dynamic nature of knowledge-in-making and knowledge-in-situ from being included in the teaching and learning process*. Reflecting upon my role as a teacher in 1993/94, I can say that the atemporal nature of knowledge embedded in the mathematics curriculum does not help teachers (i) create a differentiated and dynamic learning environment, (ii) incorporate emergent knowledges arising from students' lifeworlds, or (iii) adapt curriculum according to the emerging needs of students and communities in which they live.

Pondering about Language and Thinking

Dear Curriculum Officer, in my presentation I challenged the distorted nature of communication that is promoted by the mathematics curriculum which is oriented by the Western Modern Worldview. Have you ever realised the distortions taking place in classrooms through the bureaucratic language of mathematical proof, algorithmic problem solving and stereotypical pedagogy of transmissionism? This view of mine can be linked with Habermasian theory of communicative action (Taylor & Campbell-Williams, 1993). Over recent years, I have also incorporated a number of other perspectives, such as critical linguistics, language game perspectives and a non/essentialist view of language, so as to facilitate my quest for questioning disempowering invisibilities embedded in curriculum practices. Furthermore, I have also developed the view that language and thinking are inseparable, interactive and intertwined in such a way that one cannot be conceived without the other (Harris, 1990). In what follows, I am generating responses to your questions that are related to the language (and thinking) that orients the mathematics curriculum of Nepal.

Language

I would like to start this part of the letter with an analogy of the non/porosity of rocks. Igneous and metamorphic rocks have a very low level of porosity while sedimentary rocks have a high level of porosity. Such an analogy of non/porous rocks hints at an interesting insight into the nature or type of language that has been used in the discourse of designing, implementing and assessing the mathematics curriculum. What type of language is legitimated in designing and implementing the mathematics curriculum of Nepal? What may be its implications for the mathematics education of Nepal? In my experience, the analogy of igneous and metamorphic rocks fits well with the nature of language that is used by the mathematics curriculum of Nepal. As it goes with the analogy, the type of language that is used in the field of mathematics curriculum is largely non-porous, meaning that such a language is believed to have a singular interpretation, irrespective of context and time (Granger, 2006). In other words, I regard the language embodied by the mathematics curriculum as non-porous because it does not encourage participants to see 'pores' as a basis for searching for multiple, contextual and personalised meanings. Once conducting a professional development workshop on teaching mathematics, I felt beyond my surprise how the non-porous view of language is entrenched in the thinking and actions of mathematics teachers. Indeed, I was inviting teachers to interpret the Pythagorean Theorem on different geometrical surfaces and to rewrite (or reinterpret) the theorem if necessary. The three surfaces presented to them were: a flat table, a bell, and a soccer ball. Instead of promoting a contextual discourse most of the teachers kept on asking whether this kind of activity was allowed in mathematics education, as if it was a severe sin. Their questions keep

Perspectives on language at a glance	
Critical linguistics (Hammersley, 1997)	Inseparability between language and ideology, language and social conditions of use, linguistic process as socio-cultural process
Language games (Fleener, Carter, & Reeder, 2004; Harris, 1990)	Habits of mind, different ways of responding, language as activity, genre-appropriate actions and slice of life
Non/essentialism (Lakoff & Johnson, 1980, 1999; Lakoff & Nunez, 2000; Yamamori, 2005, June)	Dialectics of metaphor and literalism, context dependency of the essence of terms or linguistic labels, boundary conditions of concepts and labels

ringing in my mind the echo of the hegemony of the non-porous view of language, which unknowingly legitimates a singular meaning of text.

Therefore, as a result of privileging a non-porous view of language in designing the curriculum, I have envisaged three disempowering possibilities. First, the non-porous view of language legitimates the image of *curriculum as subject matter* that does not help teachers develop creativity in their teaching. Whilst working as a teacher trainer in 1998-2001, many School Supervisors expressed their dissatisfaction about the in-service teachers not following ditto the language of curriculum. Perhaps, implicit in their thinking was that in-service teachers' use of unconventional methods of teaching was not appropriate as per the 'prescribed' language of the mathematics curriculum (the techniques of proof, definitions of mathematical concepts and methods of solving algorithmic problems). In a nutshell, I argue that the image of *curriculum as an object or thing* (Pinar, 2004) does not recognise the role of language-in-making and language-in-use, rather it seems to promote the view of language having no pores or holes, and is always mono-textual. Have you ever felt being entrapped by such a disempowering language in the design and implementation of mathematics curricula?

The Moment I Speak To You

The moment I speak to you
I am not merely releasing words
I am not merely uttering sounds
I am not merely mimicking sentences
I am not merely vibrating my lips
The moment I speak to you

The moment I speak to you
I am sharing my vantage points
I am drawing my picture of reality
I am thinking of possible payoffs
I am refreshing my beliefs
The moment I speak to you

The moment I speak to you
I am calculating how much I owe you
I am wondering how I can pay you
I am undecidedly wandering
I am asking: Why are thoughts meandering?
The moment I speak to you

The moment I speak to you
I am telling a story of the day
I am disrupting your way
I am going far away and then
I am coming to my inn
The moment I speak to you

The moment I speak to you
I am longing for my presence
I am making claims of my sense
I am bespeaking complicities
I am requesting a space
The moment I speak to you

Next, I argue that the non-porous view of language embedded in the mathematics curriculum privileges the Platonic view of mathematics as a set of ideal Forms, which cannot be altered or modified. Holding the view that language depicts lifeworlds and helps construct social reality, I envisage that the Platonic Forms-inspiring language propels an exclusive view of mathematics education as a subject for those who can memorise formulae, definitions and theorems that are required for the 'appropriate use' of mathematical language (Restivo & Bauchspies, 2006). Don't you think that we need to demathematise such a restrictive nature of language embedded in the mathematics curriculum so as to harness the usefulness (writ large) of mathematics for students' present and future lives (Jablonka & Gellert, 2007)?

Finally, the non-porous view of language embedded in the mathematics curriculum is less likely to facilitate the incorporation of local cultural practices in the teaching and learning of mathematics because of the (mis)conception that mathematical language should be divorced from our ecological, cultural and social contexts, thereby remaining the same irrespective of context and time. In my thinking, if the mathematics curriculum promoted an interpretive (i.e., porous, holonic, Earth-centric) view of language (Jardine, 1994), many teachers, if not all, would be empowered to adapt mathematics according to local needs and contexts.

Thinking

Dear Curriculum Officer, I hold the view that different types of language or expression give rise to different types of thinking and *vice versa*. On the basis of my professional conversations with many curriculum workers, I have come to realise that the mathematics curriculum of Nepal promotes exclusively causal, linear, dichotomised and deductive-impositional thinking models and strategies. In my view, an extreme form of causal thinking gives rise to a deterministic (i.e., pre-designed and controlled) view of teaching and learning that promotes an exclusive pedagogical creed that well-controlled 'mathematics teaching' (perhaps stuffing?) results in enhanced learning. Perhaps, you have experienced linear thinking being prevalent in designing the mathematics curriculum through the Rational Model of curriculum development which portrays the designing of curriculum as a linear process of formulating objectives, selecting and organising experiences, and selecting appropriate evaluation tools (Ministry of Education and Sports, 2003). I argue here that such a thinking model embedded in designing and implementing the mathematics curriculum is likely to (i) prevent teachers from conceiving complex-creative visions of incorporating inclusive pedagogies in their teaching and (ii) create exclusively an artificial order that learning follows from teaching and teaching follows from assessment.

Next, I am sharing with you the notion of dichotomised thinking embedded in the image of the *mathematics curriculum as subject matter*. For me, such a thinking model promotes the tendency to separate a concept or phenomenon into two mutually exclusive parts or categories (Egan, 1999). Thus, an exclusive dichotomy between curriculum design and implementation does not help conceive a transformative curriculum vision that cultivates an inclusive and agentic dimension of mathematics education. I believe that exclusive emphasis on dichotomised thinking (i) does not provide curriculum designers with opportunities to account for complex realities of schools, (ii) creates more contradictions, thereby locking curriculum designers and implementers in a restricted framework of dualism, and (iii) does not help create a synergistic (hybrid, ecological, inclusive) view of mathematics education.

Dear Curriculum Officer, in my experience as a teacher educator the exclusive form of the deductive-impositional thinking model embedded in the image of *curriculum as object/thing* gives rise to a disempowering perspective that the Curriculum Planning Office is the source of 'premise or principle', and thus the schools are the source of 'evidence or facts'. Whilst conducting a workshop on teaching of primary mathematics in 2005, a number of teachers questioned my call for developing a contextualised mathematics curriculum that incorporates people's practices in it. (Un)surprisingly, most of the teachers resisted my idea because they thought curriculum design is not their task; rather it is a task to be performed by curriculum committees, experts and curriculum officers. They identified their role as the implementers of ideas put forward by the Curriculum Planning Office. What a hegemony of an exclusive deductive model (Fleener, 2005)? I am not saying that we need to stop such a deductive model; rather I am critiquing its hegemonic creed in designing and implementing the mathematics curriculum. Embedded in the deductive model of thinking is the impositional pedagogy that (i) does not help teachers and students to engage in a dialogic space in which students' bring their lifeworlds, (ii) has an interest of/in control rather than an interest of emancipating learners from their taken-for-granted ideas, and (iii) is not helpful for conceiving inclusive pedagogies for mathematics education.

Detouring to Knowledge and Knowing

Dear Curriculum Officer, let me start this part of the letter with a slice of my experience as a teacher educator working with a group of secondary mathematics teachers who took part in a one-week enrichment workshop organised by the University of Himalaya in 2004. As one of the pedagogical alternatives to address the perpetual phenomenon of math anxiety, I invited them to think about reflective journaling as a therapeutic tool (Palmer, 2003). By using such a tool, students could overcome their mathematical anxieties and unpack their ambiguities related to difficulties of mathematics learning. However, the participating mathematics teachers did not buy into my idea as they reasoned that (i) reflective journaling could lead to a scary domain of self-critical knowledge which does not promote pure mathematical thinking, (ii) the mathematics curriculum does not account for (prescribe) this type of activity, and (iii) such a pedagogical approach could jeopardize the absolute (infallible) nature of mathematics embedded in the mathematics curriculum, the consequence of which would result in their negligence in memorising mathematical facts, formulae and theorems.

> Who?
>
> Who can claim that all is known?
> Who can confess their unknown?
> Who can access unfathomable spirit?
> Who can identify one's inner merit?
> Who can be honest about their ignorance?
> Who can show humility and patience?
> Who can be open to new doors?
> Who can be ready to go beyond the box?
> Who can see potentials all around?
> Who can express from their deep kindness?
> Who can question their own beliefs?
> Who can live what they aspire to be in life?
> Who can share the wisdom of inter-being?
> Who can seek for the nonreal and unseen?
> Who can search for knowledges of peace?
> Who can mirror their own feelings?

How do you feel about the reasons produced by these teachers? What might be the underpinning assumptions that led teachers to express such ideas? I argue that teachers' expressions do not solely represent their isolated views; rather their expressions depict underlying assumptions about knowledge and knowing embedded in the related images of *mathematics curriculum as subject matter* and *discrete tasks and concepts*. What might be those assumptions? Perhaps, you may agree with me that the mathematics curriculum of Nepal promotes exclusively the view of mathematical knowledge as infallible, certain and objective Truth. Come with me to explore possible implications of such views of mathematical knowledge for curricular practices of mathematics.

With an exclusive emphasis on objective knowledge, the mathematics curriculum in Nepal is likely to promote exclusively conceptual (or definitional) knowing, thereby preventing teachers and students from incorporating other ways of knowing (such as critical, reflective and imaginative) in their educational pursuits. Here, I do not totally dismiss conceptual knowing; rather I am critical of the hegemony of such a way of knowing that does not help learners cultivate different forms of intelligence arising from their contexts. Curriculum Officer, I would like to request you to reflect upon your life as a mathematics student who (possibly) rote memorised relentlessly a vast number of mathematical theorems, definitions and algorithms as the basis for a correct form of conceptual understanding of mathematical concepts prescribed by the curriculum. Do you think that this mode of knowing helps understand mathematics creatively? Do you think that a handful of mathematical formulae can really enable us to solve mathematical problems embedded in the entirety of our lifeworlds?

From my perspective, the ‘development (or design) paradigm’ of curriculum (Pinar, Reynolds, Slattery, & Taubman, 1995) promotes the foundational view that the source of knowledge is subject-related disciplines. Such a perspective of knowledge regulates discourse about and procedure of curriculum development, thereby legitimating a very narrow view of knowledge: that the only source of knowledge to be incorporated in the mathematics curriculum is the disciplinary foundation of mathematics (Beane, 1995, 1998). The implication of the foundational view of knowledge for the mathematics curriculum is a license to unquestioningly transfer the ‘table of contents’ of a mathematics textbook to the list of subject matter of the mathematics syllabus. In this way the mathematics curriculum does not embody the ever-developing nature of mathematics as a domain of inquiry, rather it presents a distorted view of mathematics via the image of *mathematics as unchanging knowledge*. Had the school mathematics curriculum well represented the ever-developing and dynamic nature of mathematics as a discipline, it would also have included different types of geometry, non-deterministic equations and fuzzy logics.

Critiquing the Mono-Cultural Perspective

Dear Curriculum Officer, starting this segment of the letter reminds me of a meeting with a group of curriculum experts in 2005, in which a reform-minded curriculum officer presented his vision to incorporate aspects of local cultural practices in the school mathematics curricula. Unsurprisingly, the first person to critique such a view was a mathematics professor who said that the mixing of 'culture' with mathematics would lead to an incorrect understanding of mathematics. The next person to critique the view was the officer's department chief who argued that such an off-the-ground proposal would not promote a quality education. As the discussion became somewhat heated, I spoke in favour of the officer stressing the need to incorporate culturally-contextualised knowledge and skills so as to improve the quality of mathematics learning, and provide students with opportunities for crossing borders of different worldviews (Giroux, 1992), including the Western Modern Worldview and Nepali Cultural Worldview[74]. However, none of these views seeped into the entrenched belief that the main goal of the mathematics curriculum is to drive students away

> Monoculture
>
> A machine speaks, *heartless*
> A subject bows, *compliance*
> A dissident is expelled, *tyranny*
> No question is raised, *hegemony*
> Truth is only my Truth, *singularity*
> True God is only my God, *supremacy*
> Valid Word is only my Word, *authority*
> Good sense is only my sense, *bigotry*
> Follow me to get there, *certainty*
> Think logically devoid of feeling, *rationality*
> Remember the basics of trade, *control*
> You have to know this, *imposition*
> I don't wear a hat so you mustn't, *disguise*
> I am important, *privilege*
> Just do it; no reason is needed, *invisibility*
> Outside world is everything, *partiality*
> Math is all about symbols, *distortion*
> Define literally in this frame, *essentialism*
> I will save your culture, *colonisation*
> Select one from two contraries but not both, *dualism*

[74] The formulation of Nepali Cultural Worldview is my attempt to offer a worldview alternative to the Western Modern Worldview. In my mind, key characteristics of such a worldview are: organic approach to knowing, ecological consciousness and community.

from their lifeworlds and make them extremely self-indulgent in decontextualised, abstract and narrowly conceived algorithmic thinking (Luitel & Taylor, 2007).

Without intending to prove that all curriculum experts and officers want to promote the culture-free notion of mathematics, I am trying to share my perception with you that the mathematics curriculum of Nepal un/wittingly reproduces a singular view of mathematics inspired by the Western Modern Worldview, which promotes a mono-cultural view of mathematics education via (i) the procedural-bureaucratic language of technical rationality, (ii) the dualistic logic of proposition, deduction and analysis, (iii) the nature of mathematics as a body of pure knowledge, and (iv) the image of mathematics as a collection of muted symbols and algorithmic procedures. Am I over theorising? Or, am I making sense according to your experiences?

Thus, I argue that the myth of culture-free mathematics is a disguise to impose the mono-cultural hegemony of the Western Modern Worldview in mathematics curricula. Perhaps, you agree with me that such a culture of hegemony is not helpful for incorporating multiple knowledge systems arising from the students' lifeworlds in the mathematics curriculum. How can we make mathematics meaningful if it is not contextualised, at least to some degree, according to students' lifeworlds? Can a decontextualised mathematics education maintain an inclusive epistemic responsibility (Walshaw, 2002)? In my mind, the mono-cultural hegemony of the Western Modern Worldview-inspired mathematics is an obstacle for students and teachers to (i) conceive that mathematics education offers creative and contextual approaches to social-communal problem solving (other than algorithmic problem solving), (ii) realise the usefulness of mathematical knowledge in their present and future life-roles as active citizens, and (iii) make connections between their experiences and mathematical knowledge they encounter.

Although the mathematics curriculum of Nepal promotes a culture of epistemic certainty (promoting surety through a self-referential or self-evidential method of justification, which is often called axiomatic (Eves, 1990)), many students are likely to feel (emotionally) uncertain about their learning. Reflecting upon my experience as a student of mathematics, the learning area that would most put me in trepidation of uncertainty was mathematics. I was uncertain about my understanding of mathematics. I was uncertain about the correctness of my use of algorithms. I was uncertain about the geometrical proofs that I was developing. Did you feel the same way? Did you experience 'math anxiety' during your life as a student of mathematics? Although I was a 'good' student, some forms of 'math anxiety' make their home in my life as a student of mathematics. I am not making a general claim that math anxiety is caused necessarily by the culture of certainty embedded in the mathematics curriculum of Nepal; rather, the culture of certainty did not offer ways to overcome such anxieties. Thus, I argue here that the culture of exclusive certainty is likely to turn students into dependent apprentices rather than creative, independent and collaborative workers (Taylor, 1998). By making students passive recipients of mathematics knowledge, it is less likely that they act as critical users of mathematical knowledge. Here, my notion of critical user represents those learners who are aware of the limitations of knowledge that they are learning, applying and adapting.

Finally, I argue that the mono-cultural perspective embedded in the mathematics curriculum promotes a culture of compliance, meaning that students are termed successful as per the extent to which they obediently reproduce definitions, formulae and theorems. Whilst complying with the conventions of pure mathematics, students are less likely to think about local mathematical categories, practices and knowledge systems arising from their lifeworlds. Perhaps, you may agree with me that a culture of compliance prevents students from (i) cultivating healthy scepticism toward the mathematics they are studying, (ii) developing themselves as autonomous, self-producing thinkers and actors in their present and future lives, and (iii) establishing meaningful links between the *pure* (arising from the Western Modern Worldview?) and *impure* (arising from Nepali Cultural Worldview?) mathematics, which can be useful for moving beyond the narrowly conceived boundary of disciplines (see Section One).

Dear Curriculum Officer, in this way I come to the closure of this letter. I do hope that you have enjoyed reading this rather long letter. Whilst writing this letter, I have one thing in mind: *I am not writing this letter to convince you; rather I am sharing my ideas with a view to creating a dialogic space for cultivating emergent views and perspectives about curriculum.* Finally, I hope that I will be able to read your next letter soon.

Sincerely Yours

Bal Chandra Luitel

Section Five

FADE TO BLACK

CHAPTER 12: APPRAISING MY ROLE AS A CURRICULUM COMMITTEE MEMBER: MAKING SENSE OF SITUATEDNESS

Devil's Advocate: I Have Questions And Critiques!

September 2008

Curriculum Planning Office

Block D, Indra Nagar

Kathmandu Nepal

Dear Bal Chandra

Thank you for inviting me to this dialogic space of knowing each other's perspectives. Whilst acknowledging your efforts to respond to my earlier letter that raised a number of questions about many visible and invisible assumptions underlying the mathematics curriculum of Nepal, I am going to share some of my critical observations about your roles in Curriculum Committee meetings. Therefore, my texts may sound somewhat critical, compelling you to come out of your comfort zone to reflect upon possible contradictions in your thinking and actions. In writing this letter I remind myself of a boomerang, a metaphor for critiquing yourself from vantage points that you have subscribed to in your earlier letter.

?

Which is whose voice?
How can 'i-we' portray as clearly as possible?
As we co-generate voices and texts
Ownership of voices and texts blurs

In a dialectic of self and other
How does a co-generation take place?
Self and other speak and co-speak
They hear and co-hear
Blurring the role of speaker and hearer
Apparent gives rise to obscure
Obscure makes sense of apparent

Self makes sense of other
By stretching it-self to reach out to other
Other makes sense of self
By combining self, selves and no-self

My deep-seated intention of proposing you as a member of the Essential Mathematics Curriculum Committee was: to help (or facilitate) the *committee members to know more about recent trends in curriculum development. I doubt that the committee members got such an opportunity. Please correct me if I get this wrong: you did not exert influence which could help the chairing professor and teacher representatives gain insights into what you have mentioned as multiple realities in the previous letter and in your talk that you gave in 2005. As teacher representatives of the curriculum committee used 'course completion' and 'forty-five minutes' class hour' as factors to make a case for content reduction, I expected you to counteract their entrenched belief of teaching as content transmission. Surprisingly, you supported their ideas of content reduction, with an emphasis on creative teaching strategies. Nonetheless, I like your notion of creativity as an approach to thinking and acting unconventionally. I do hope that the teacher representatives benefitted from your perspectives on creative teaching. Perhaps, if you also helped them understand the notion of multiple realities, they would definitely be enlightened and would think twice before making any parochial comments on our work.*

Dear Bal Chandra, can teachers not be held responsible for their short-sightedness, singularity and narrow-mindedness? I am raising this question because, at times, you were very much supportive of teachers' ideas. As a result, teacher representatives continued to privilege their one-sided view of everything including curriculum, pedagogy and education philosophy. Can privileging their singular view of reality help us think and act creatively and responsibly? In curriculum committee meetings teachers often repeat the same odd rhetoric: students are not good at mathematics; there is much content to cover; we do not have money to buy educational resources; and the curriculum is not at par. I am sure you spotted these comments made by teacher representatives during our meetings as well. Yes, you mentioned to them that the classroom is constitutive of multi-dimensional reality, the reality of teachers, students, parents and bureaucrats. But I could not see them acknowledging the notion of multiple realities, nor did they realise that they are not accounting for what you called 'creative pedagogies'. I am not saying that all of their opinions and comments were wrong. Rather some of their views about teaching and learning of mathematics projected a sheer lack of forward-looking thinking. Could I not expect you to challenge such views to develop a student-centred vision of mathematics education?

I always held the view that improving mathematics education needs coordinated action to generate meaningful classroom experiences in students. For this, a clear recommendation of content-specific teaching techniques can help teachers bring changes to their conventional style of teacher-centred teaching. I expected the committee to come up with some concrete recommendations about ways in which particular mathematical subject matter could be taught by involving students actively. You offered some generic (or theoretical?) ideas about how we can teach mathematics by linking it with students' everyday practices. Then, I put a proposal that we develop a kind of scope and sequence chart, mentioning creative teaching techniques for each topic of the curriculum. In this way we could enhance the quality of mathematics teaching in schools. I have to admit sadly that you indirectly opposed my proposal, terming it a way of instilling 'teacher proof-ness' in the mathematics curriculum. How can you say that a teacher-proof curriculum is always a bad curriculum?

Dear Bal Chandra, I am taking you to one of our committee meetings in which the chairperson proposed – perhaps ironically – that you take the responsibility of revamping the entire curriculum of Optional Mathematics. I guess it was another good opportunity for you to solely consolidate and impose your own vision of what you have called inclusive mathematics education. I couldn't bring myself to agree with your approach that all committee members would propose their views and make decisions accordingly. Well, participatory approaches are good, but their goodness depends upon the quality of participants as well. How can you expect radical ideas from conventional mindsets? Unsurprisingly, we met with disasters as the teacher representatives and chairing professor presented the rhetoric of this-is-not-possible-in-our-country. You presented your vision of restructuring the Essential Mathematics Curriculum, but you couldn't stick to this. In my perspective your use of probabilistic language weakened your position. Had you used definitive and bold language, you could probably have taken over their proposals!

I may sound cynical here but my perception is: our mathematics teachers are very difficult people to involve in reform initiatives. In my experience as a Teacher Trainer, School Supervisor and Curriculum Officer, mathematics teachers hardly account for multiple realities, inclusive pedagogies and unconventional approaches to dealing with educational problems. I always aim to alter their tyrannical attitudes *and narrow-minded pedagogies whilst designing mathematics curricula and other curricular materials, such as teachers' guides, scope and sequence charts and assessment-related guidelines. My deep-seated desire is to see mathematics classrooms full of meaningful learning experiences that can help improve student performance in mathematics. Can it be possible to impart meaningful learning experiences by teachers with century-old ideas? Should we not intervene in their ways of thinking and acting?*

My questions, comments, critiques and cynicism are a result of my desire to see you act differently. By acting differently you could change some aspects of the curriculum. I may be wrong. I might not have noticed differences. In the end, I hope that my letter does not disturb your inner peace as many people find it hard to digest criticisms and comments. I am looking forward to hearing your responses soon.

Sincerely yours

Curriculum Officer

FADE TO BLACK

October 2008

10023 Far Out Street

Mother Goddess Town

Dear Curriculum Officer

I am delighted to read your second letter which offers me an opportunity to reflect upon my own situatedness and respond to some of the questions mentioned in your letter. In responding to your questions I will use four major conceptual strands to organise my perspectives about my actions during the meetings that I attended four or five times in the year 2005. In the first part of the letter I will respond to your interventionist aspiration of improving mathematics pedagogy via a teacher-proof curriculum. To do so, I will use complexity science and Integralism as referents. As your questions and comments touch upon various issues of pedagogical importance, I will take the perspective of transformative actions to comment on and question your approach to improving Nepali mathematics classroom with an emphasis on inclusive meaning-making pedagogies. Elaborating on the view that curriculum should be conceived through multiple ways, the third part of this letter deals with a metaphorical approach to reconceptualising the concept of curriculum. Agreeing with your comment that I was not very vocal and did not try directly imposing my ideas on the curriculum committee members, I will be reflecting upon our (mine and your) situatedness with a brief take on un/sustainable logics of practice. Writing in this propositional way, I am somehow canonising my text via the academic conventions of our time. Nonetheless, I am trying to maintain some degree of letter writing spirit in this space of textual construction. Are you ready to take this journey with me?

> My Humble Request
>
> I am repeatedly pleading with you
> Think beyond what you view
>
> My dear friend, you are still there
> Forgetting limitations of your nose and ear
>
> Hanging on the straight line
> As if a cloth being hung to dry in the sun
>
> I say, don't always 'come to the point'
> 'The' point may not depict the entirety
>
> Think about jolts, joins, and bumps
> Visualise your lines beyond the flat surface!

Complexity in Context

Dear Curriculum Officer, you are right to say that I did not try exerting influence on the members of the Mathematics Curriculum Committee. I agree with you that I could have shared the notion of multidimensional reality and multiple realities. Indeed, I have to be honest that I was not fully aware of the notion of complexity science and Integralism at that time; rather I was guided by three key perspectives coming out of innovative educational research studies: *contextualism*, *postmodernism* and *criticalism*. My suggestions about incorporating people's cultural practices in the mathematics curriculum according to students' lifeworlds might have been linked to contextualism (Taylor et al., 2007), whereas my proposal to bring multiple views to the meeting might have reflected two key features of postmodernism: pluralism and difference (Taylor, 2008b). And it might have been criticalism that helped me to be (overly) sympathetic to teachers because I believe they are regarded as a group of subalterns, who are not well recognised for their efforts.

My recent readings of complexity-inspired perspectives (Davis, 2008; Kuhn, 2008) have also helped me reflect upon your critique of me supporting a non/interventionist means of curricular transformation. Perhaps, an important departure of complexity science from its Newtonian counterpart (the scientific basis for the Western Modern Worldview) is its enduring emphasis on contexts leading to the image of reality as multiplistic and emergent (Haggis, 2008). With a view to promoting the discourse of a contextualised mathematics curriculum, I wanted to hear more from teacher representatives. This process might have helped me (and you) understand how contextual factors give rise to multiple views of curriculum. In my mind the moral basis of complexity science is in the facilitation of the emergence of concepts and ideas rather than in the imposition of our vantage points. How can we understand complexities associated with curriculum development and implementation if we are not to listen to others, especially teachers? Nonetheless, I am not claiming that I was acting *totally* in accordance with the perspective of complexity science or any other theories. Rather I prefer to regard complexity science (or any theory) as an interpretive referent that can help interpret some of my experiences from a particular vantage point. Neither are all my experiences in high fidelity with complexity science nor do I purport to claim that this is the ultimate theory of everything, including curriculum.

Complexity

A group of invisible storms
Make their ways to nostrils
They create a gale inside the lungs
The in and out generate a turbulence

A small change -- be it a viral mix
Or be it a peep of pandemic
Or be it a small amount of smoke --
exerts big bodily impacts

The message runs
through millions of veins
They travel nonlinearly through neurons
It is not that some guys are posties
And others are receivers
They work in ways
that it is hard to know who does what

In this way they guard the system
To overcome the untoward situation
Good guys auto-create forts
So that the bad guys find it hard to distort
My body gets refreshed
as this happens moment to moment

I cannot imagine my body
without functional nonlinearity
without emerging fractals of neuron
without self-production
that upkeep my nervous system
I cannot think of me
without a contextual meaning
that gives my sense of being
But this ‘me’ is not just a causal self
rather it is a complex web of self, non-self,
no-self and Self

Section Five

Next, I would like to bring to your notice the notion of systems thinking which seems to challenge the longstanding piecemeal – sometimes it can be called systematic – approach to solving curricular problems. Your aspiration to bring about change in mathematics education is highly commendable. What is missing is systemic thinking, an holistic approach to conceiving a system and its constituents via interactive, interconnected and interdependent relationships (Smitherman, 2005). Please don't take it badly but your letter advocates a piecemeal approach that focuses on a small unit (classroom teaching) whilst not accounting for other systemic constituents associated with it.

Dear Curriculum Officer, I think I encouraged teacher representatives to speak up in the meeting even if they critiqued me, you and the Curriculum Planning Office. I held (still hold) the view that every practitioner has agency for her/himself. The notion of agency changes the status of teachers and students from being a means to others' ends to acting as ends in themselves. I have come to know recently that complexity science also helps us conceive an individual as a self-regulating and self-producing system (Semetsky, 2008). If we are to conceive and implement fully the notion that each teacher is a self-regulating and self-producing system, we need a vision of involving teachers in creating and implementing mathematics curriculum in context. How can we help teachers (and curriculum officers) realise their self-producing potential, which is not currently being cultivated well due to the exclusive image of *curriculum as subject matter*? Can we do this by imposing our own agenda, egotism and one-sided views? In my experience of participating in meetings of the Essential Mathematics Curriculum Committee, our curriculum design approach did not seem to account for the self-producing potential of individuals; rather it tended to project teachers and students as those who should act to fulfil the interests of dominant others.

Dear Curriculum Officer, it is a pleasant coincidence that my earlier (in 2005) held view of emergence as a condition for meaningful knowledge generation appears to match well the key feature of emergence of complexity science (Osberg, Biesta, & Cilliers, 2008). Well, there may be different interpretations about embodying emergence in a politically charged activity, such as designing and implementing the curriculum. Perhaps, one of my morals for emphasising collaborative discussion as a means for revising the Essential Mathematics Curriculum could be connected with the notion of emergence. I held (and hold) the view that collaborative approaches, if guided by the notion of (Habermasian) ideal speech situation, are a great way for emergence to flourish in our thinking and actions. Well, I could have 'imparted' the notion of emergence to the committee members. Which one is more appropriate: informing about the concept of emergence or trying to embody it and demonstrate through my own professional practice?

The Voice of Solitude

Why am I here?
You said this is a question of nowhere.
I insisted on searching for meanings.
You turned down my advice
by choosing to walk along a narrow footpath
with an interest in serving a contracted self

I repeated this question several times
Let's find the meaning of 'here', thus
Is it a solitude that gives its notion?
Is it a symphony that generates its rhythm?
What is this that gives the sense of here?
You said again these are questions quite bizarre

We parted. Where are you headed for?
Did you drink enough to hide your profound nature?
(Because at least you have a soul)
Did you bury your feelings?
Into the burrow of so-called rational reasoning?
How did you work out with your gut?
Perhaps they become redundant obstacles.

You reduced the world to cipher
You tuned the mantra: prosaic language is superior
Poets began to cry, creation stopped
Plagiarism became the only knowing mode
You claimed that the sentence is a tube
That can send meaning from mouth to mind

For those who could not plagiarise
Your reasoning was of unconceivable size
You preached a partial past and a dull future
You never realised that there was a rupture
The glue could be now, the conversing moment
That could help you realise being in the context

Why am I here?
Now I am very close to your door
Open it and let me in your home
I can share the wisdom of creative being
You can fill me in with your dull description
One day you grow old. You will be weak
Will you realise the value of the creative inner world?

Section Five

Transformative Aspirations and Actions

Dear Curriculum Officer, I am really touched by your heartfelt aspiration for turning mathematics classrooms into an inclusive enterprise of meaningful learning. Aspirations play a vital role in lives of people who want to make a difference. Nonetheless, sometimes their pristine aspiration is distorted due to a possible mismatch between their vision, actions and perceived outcomes. In my perspective, your pristine goal of changing the mathematics classroom from a boring station of exclusive transmissionist pedagogy to a creative space for generating meaningful mathematics has been trapped by a reformist agenda which often situates you within a narrow framework of mathematics education. Such a framework locks in a restricted worldview thereby delimiting you within conventional, conformal and reformist agendas (Mezirow, 2005). For me, your exclusive emphasis on developing a teacher-proof curriculum is less likely to make sustainable changes in classroom lives. Why do you take the risk of preparing the same readymade meal for the entire

Transformation

Who are you?, asks an unknown
I *am the sun*, I say with my high tone
I can lighten the life of the common
I can take away ignorance
I can serve day and night
I can always see their plight

Who else are you?, inquires the unknown again
I am the moon, I reply with a gentle tone
I can help people be calm and rejoice
I can inspire them to be a source of inner peace
I can help people minimise waves of pain
I can inspire them to embrace the uncertain

Who else are you?, asks the unknown again
I am the Mother Earth, I reply soberly then
I can request people to expand their hearts
I can ask people to stretch their caring hands
I can convince them to denounce narrowness
I can persuade them to maintain co-existence

Who else are you?, quizzes the unknown
I am the ether, I speak quietly again
I can request all to embrace non-discrimination
I can ask to live the life of a caring person
I can knock on their door at any time
I can unlock their narrow minding

This much?, stares the unknown at me
My 'self' comes not from this self, I reply gently
I can free my ego and request others to do the same
I can have a name or I can live it alone
I can convince people to realise these notes:
Our self is not formed by itself but by non-self
Why are you so indulgent in your own self?

And finally?, speaks the stranger
I am you and you are me, my reply creates a metre
We are unity in diversity. We form a whole forever
We are affecting each other
As we overcome the consciousness of separateness
There is no parting of the familiar and the stranger

population of teachers and students? Why do you not give some ingredients and invite them to create a multitude of meals, instead?

I, thus, believe in going beyond and prior to the so-called unquestionable framework (i.e., Tyler's rationalistic model and its sequels, including Hilda Taba's model (Ministry of Education and Sports, 2003)) of the Curriculum Planning Office so as to conceive the gravity of the problem faced by teachers and students due to the decontextualised, elitist, exclusive nature of mathematics incorporated in the mathematics curriculum. I passionately request you to think about these two conceptions, *beyond* and *prior*, which can be linked with specific Buddhist and Vedic traditions (Nagarjuna et al., 1990; Wood & Sankaracharya, 1974). *Going beyond* is about thinking and acting beyond the limitations of everyday practicalities whereas *going prior to* apparent conceptions and frameworks is about realising the interdependence of various contributing factors that give rise to the present problem of exclusion and elitism in mathematics education. Perhaps transformative approaches are helpful for us to realise the interconnectedness of real and non-real, seen and unseen, and felt and reasoned aspects (Greene, 1995) of the problem of culturally decontextualised mathematics education. Do you really feel that mathematics teachers are solely responsible for the exclusive, decontextualised and elitist posture of mathematics education in Nepal?

You kept on blaming teachers for being tyrants, without referring to our own social and cultural institutions which promote various forms of tyranny. Even in my case, I cannot deny that I do not possess any form of tyranny within me. One of the approaches that helps overcome our own tyrannical attitudes and behaviours is self-reflectivity. Can you guarantee yourself that you are free from tyrannical thinking and actions (Hanh, 2000)? Nonetheless, I am not supporting a form of tyranny that condescends to free and creative thinking; rather, I am requesting you to examine your own and your institution's possible tyrant values which greatly affect teachers' professional lifeworlds. In my mind we (you, I and teachers) are a form of social and cultural webs in which one's way of being impacts others. Thus, a transformation that starts from you and I can be more sustainable than the transformation that we wish to take place first in others. Why don't we embrace Gandhi's popular dictum that to change others we better be the change in ourselves (Khanna, 1985)?

Dear Curriculum Officer, I am not denying the possibility of the teacher-proof curriculum in helping teachers to teach mathematics in a meaningful way. But an extreme form of teacher-proof curriculum that you have in place turns teachers into mechanical vessels that do not require critical or creative thinking. Do you want teachers to be a robot-like medium of knowledge transmission rather than soulful facilitators who strive to embody creativity and forward-looking vision? You mentioned in your second letter (p.276) that you are interested in promoting quality teaching in school mathematics. What kind of quality are you talking about? I believe that quality in mathematics education cannot be inculcated fully via the exclusive emphasis of a one-size-fits-all curriculum and pedagogy. In my mind, quality mathematics education is able to: (i) help students connect mathematics to their lifeworlds, thereby forming meaningful synergies between their culture and the mathematics they study; (ii) make students aware of the potentials and limitations of the mathematical knowledge they study; and (iii) facilitate students to use mathematical knowledge to act as responsible and active citizens (Giroux, 2001; Jenkins, 2006; Zembylas, 2005).

Delving into Multiple Images of Curriculum

Dear Curriculum Officer, I am responding to one of your concerns, *why I supported the teacher representatives' view that the content of the Essential Mathematics Curriculum <u>should</u> be reduced*. I hold the view that metaphors or metaphorical images are a way to capture complexity enshrined in the concept of curriculum. However, we need to be aware that an un-reflexive and uncritical use of metaphor cannot help you be transformative (Bowers, 2009). I argue that a definitional (i.e., literalist) approach to conceiving and operationalising the notion of curriculum captures only an aspect of curriculum, thereby restricting empowering possibilities enshrined in metaphorical approaches. In my experience the definitional approach to conceiving mathematics curriculum puts asymmetrical and exclusive emphases on the image of *curriculum as subject matter* and *discrete tasks and concepts*. Whilst supporting the teacher representatives' idea of reducing the amount of content, my sincere aspiration was: to help create a space in which some empowering curriculum metaphors can help them conceive and translate inclusive and transformative pedagogies into action. Is this wishful thinking?

For instance, having the image of *curriculum as an agenda for cultural reconstruction*, mathematics teachers can use mathematics as a tool for facilitating students to unpack problems in their socio-cultural milieus and find possible solutions that can contribute to changing their cultural landscapes as just and equitable. Through this process, mathematics teachers and students may be able to develop a critical and synergistic vision as a result of situating mathematics within a socio-political interactivity. Tamy Spry (2006) talks about socio-political interactivity in a research context, but I think this is equally important in the context of mathematics education. Can this be possible through the extremely 'content' and 'discrete tasks'[75] -driven curriculum images of the school mathematics of Nepal?

One and Many

Don't show me this monochrome again
I say to the photographer with passion
Please bring images of different effects
I say, *the monochrome is not enough*

Why don't you like the realistic image?
The photographer says,
You have a surprising craze
Rejecting what is real, true and exact
What are you trying to achieve?

How do you know your image is real?
I question, *why don't you think of multiple?*
Your exactness can be bounded
Your truth can be misguided
Come on, construct multicoloured image-icon
Not just one from one, but many out of one

Colourful images are inspirational
Don't worry about real, unreal and nonreal
I am happy with all of them
But be aware I need a great deal of collection

The photographer begins to listen
As if he is going to be educated soon
I say, *strict boundaries have no charm*
Just like being restricted inside a locked room

I stress further, *images signify possibilities*
They embody normal, abnormal and otherwise
My friend, use as many pixels as you can
I encourage, *use as many effects as you can*
Employ multiple lenses to capture dimensions
Apply colour combinations for imaginations

Finally the photographer nods
I continue with my proddings
The world is colourful and so are our beings
Allow images to sprout freely from your lenses
Remember many is the essence of one
And one is a basis for and gives rise to many.

Dear Curriculum Officer, in my observation, as a curriculum worker

[75] For mathematics professors, there can be a coherent relationship between subject matter, algorithmic exercise and algorithmic problem solving. But for students this relationship is still invisible because of the emphasis on rote-memorisation. Thus, each mathematical concept and task appears too unconnected and discrete.

and practitioner, the rationalistic protocol by which the Curriculum Planning Office designs the mathematics curriculum does not encourage students and teachers to cultivate their personalised (autobiographical) understandings of mathematical knowledge that they teach and learn. In my mind by incorporating the image of *curriculum as currere*, students and teachers are able to link their being (and becoming) with their knowing (and valuing). As teachers begin to make autobiographic connections between the subject/topic/content they teach and their reflections upon their engagement with the curriculum, it is likely that they become reflective of their deep-seated values (Pinar, 2003). I argue here that such a connection-making act is highly likely to be a means for sustainable self-development. Furthermore, whilst provided with opportunities to make sense of mathematics through their autobiographical impulses, students are likely to generate personalised and contextualised meanings of the mathematics that they study. In this way a pedagogy that promotes self-knowledge interactivity can pave the way for promoting meaningfulness in mathematics teaching and learning.

Perhaps, you may find it easy to respond to this question at this point: Why does an exclusively subject matter-based image of curriculum not help realise experience-based knowledge? In my view, experience is an empowering phenomenon which posits each individual (a social, cultural and political being) to be a unique source of knowledge. Furthermore, the phenomenon of experience helps us resolve the duality of ends versus means (Bagni, 2008), thereby offering more inclusive ways to conceive pedagogies in mathematics education, whereas the image of *curriculum as subject matter* has been conceived as a playground for many unhelpful dualisms. I argue here that bringing non-dual pedagogical approaches (such as collaborative, process oriented pedagogies) is possible whilst incorporating the image of *curriculum as experience* into the process of designing and implementing the mathematics curriculum. As you have experienced as a student, it was highly unlikely that your mathematical experience arising from your lifeworlds would be valued by the teacher. Here, let me remind you of John Dewey who argued for a lifeworlds-oriented education that does not promote an unhelpful dichotomy between means and ends (Niznik & Sanders, 1996). If I use Nagarjuna's logic of dependent co-arising, I find the notion of means being referred to and connected with the notion of ends, *and vice versa* (Nagarjuna et al., 1990). Don't you think that the image of curriculum as experience is more inclusive of students' lifeworlds than the image of *curriculum as subject matter* and *curriculum as discrete tasks and concepts*?

Dear Curriculum Officer, I do not believe that curriculum images other than *curriculum as subject matter* and *discrete tasks and concepts* will be automatically incorporated into the mathematics curriculum after reducing the *content* of the syllabus (or subject matter). Yes we need a coordinated effort from the Curriculum Planning Office, teacher preparation institutions and in-service teacher training bodies to place emphasis on the view that curriculum is more than a thing or object (or a document or a sequence of subject matter), rather that it is also the pursuit of creative envisioning of what might the present and future lives of students hold. In this process various images of curriculum can make their way into teachers' hearts and minds. For example, *curriculum as conversation* is likely to promote a dialogical relationship between different actors involved in designing and implementing the mathematics curriculum. The image of *curriculum as conversation* can also be interpreted as a way of introducing healthy scepticism into mathematics pedagogy because conversants are likely to ask the 'why' question. Next, whilst considering the image of *curriculum as complexity*, I prefer not to delimit the notion of curriculum through the billiard ball view of rationality (Doll, 2002). What is likely to be the nature of our mathematics pedagogy if we consider the image of *curriculum as cosmology*? Perhaps, it helps you and me to look prior to and beyond the believed-to-be-inert content of mathematics and realise the dynamic nature of knowledge, mirroring the evolving interconnection between humans and non-human attributes of the cosmos (Doll & Gough, 2002).

Dear Curriculum Officer, thus such curriculum images (*curriculum as an agenda for social reconstruction, currere* and *experience*) provide us with different (sometimes contradictory, contrasting) visions of teaching, learning and assessment. I am not sure whether I held this view consciously whilst serving as the Curriculum Committee Member, but now I wholeheartedly feel, mindfully realise, and logically express that synergy is needed in developing and implementing the mathematics curriculum. In a similar way to our body arising out of quite contrary *bhūtas* (i.e., elements), the idea of curriculum is constitutive of contrary constituents, elements and ethos.

Section Five

Featuring Un/Sustainable Logics of Practice

Dear Curriculum Officer, you have critiqued that I did not have the will to take sole responsibility for restructuring the Essential Mathematics Curriculum proposed by the committee chairperson. Yes, I did not want to take sole responsibility for such a task as that endeavour would be less sustainable than a collective decision made by the group on revising the Curriculum of Optional Mathematics. I am not saying that I oppose personal initiatives; rather I do not favour an exclusively impositional method of decision making. If I chose your logic of practice, I could be a hero for a while. But, I doubt its sustainability after my absence. Here, my notion of a sustainable logic of practice is: a meaningful synergy of thinking, actions and goals through critical reflection that lead to an inclusive envisioning (Semetsky, 2008). What may be key influencing factors that shape your logic of practice? How can our (yours and my) practice as curriculum workers be sustainable? Let me explore possible issues embedded in these questions.

> Self and other
>
> They are wrong, you assert
> I have information and I am correct.
> They are ignorant, you maintain
> I know more, so I can teach them
>
> But my dear friend, who are you
> to separate yourself from the milieu?
> Who are you
> to label others as mistaken?
> Who are you
> to authorise yourself to be full of ken?
>
> Why did you forget
> that you cannot teach but facilitate?
> Why did you unlearn
> that part of correctness constitutes mistake?
>
> Whilst you blame them
> You are blaming your own
> How can you exist without them?
> Only when-
> you lose your sense of connection
>
> You can produce a speech
> They hardly have a voice
> You live in the source of information
> They work at the end of the assembly line
>
> Free yourself from all kinds of masks
> Come out of the cocoon of separateness
> Wake up from the pretention of sleep
> Days can fall short if you go on like this
>
> Pay attention to your heart
> You can see all are you, and that
> frees you from unsustainable thinking
> Go inside you and find a caring being

I hold the view that your deep-seated desire to have power over teachers' thinking and actions through a teacher-proof curriculum reflects the control-propelling logic (Fleener, 2002) that might have arisen from the centralised ethos of the Curriculum Planning Office. In my experience as a curriculum worker, hegemony, reproduction and order are key attributes of the logic of practice promoted by the Curriculum Planning

Office. The everything-is-going-well-with-my-view attribute of hegemony is less likely to offer you a lens that helps see the unseen, especially the disempowering forces embedded in your (and my) thinking and actions, as it has a tendency to regard perpetual normalcy as a given. Next, the Curriculum Planning Office appears to promote a 'reproductionist' agenda through a sole emphasis on the privileged image of *curriculum as subject matter* and the assessment system that demands students to reproduce subject matter as it is. Unless you radically change the logic of rote-memorise-and-you -will-pass to the logic of be-creative-unconventional-and-imaginative-and-you-will-qualify, your desire to change the mathematics classroom from a boring station of rote memorisation to a site for meaning generation will remain elusive.

Dear Curriculum Officer, I argue that order is another key feature of the logic embedded in your practice. And, it is so entrenched in our psyche that we cannot think positively of any forms of disorder. As you resist my emphasis on inviting teachers to speak about their experiences, you seem to be fearful of any form of disorder created by teachers' comments and criticisms. In my mind without a certain level of disorder, you cannot make good sense of order (Doll, 2008). You may be thinking right now that I am going crazy as I want to replace orderliness by disorderliness in designing the mathematics curriculum. Indeed, I am of the view that exclusive orderliness is less likely to help embrace creative, innovative approaches to conceiving and designing the curriculum. These features suggest that your (and probably my) logics of practice are unsustainable as they give rise to unhelpful dualisms, hierarchy and a culture of blaming others. The tendency of separating actors from the context of acting gives rise to several contradictions such as these: (a) a curriculum worker sees problems in teachers but not in his/her impositional approach, and (b) a teacher sees problems in students but not in her/his transmissionist, elitist and exclusionary pedagogy. Can you really improve mathematics without breaking such a vicious circle of blaming?

I cannot claim that I acted in a sustainable way as a Curriculum Committee Member. As a curriculum worker, I strive to act in ways (a) that maximise open and empathic communication (Denton, 2005b) with others, (b) that demonstrate transparency of my intentions, and (c) that I am inclusive of differing viewpoints arising from other people's perspectives inasmuch as they contribute to designing an inclusive and empowering mathematics curriculum. You may hold the view that the culminating goal of designing curriculum is the product (curriculum document) rather than the thinking and actions of committee members and their perspectives. But I choose not to accept your perspective totally. You can prepare a high quality curriculum document but if you fail to be inclusive, empathetic and transparent in your thinking and actions, other stakeholders are less likely to own the document and act on your behalf. Thus, you will soon be formulating another committee to replace the earlier curriculum document.

Dear Curriculum Officer, in this way I respond to your comments on, questions of and concerns about my situatedness as a curriculum worker. In some parts of the letter I might have appeared defensive. But my intention is not to do so exclusively, rather I am intending to offer alternative interpretations of situations, as some of your questions (perhaps un/intentionally) tend to depict situations in a particular way which might not account for multiple dimensions of your and my situatedness as the committee members of the Essential Mathematics Curriculum Committee. In the end, my best wishes to your endeavour to transform the curricular landscape of mathematics education in Nepal. I am looking forward to reading your emerging questions and concerns. Please do write to me!

Sincerely yours

Bal Chandra Luitel

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CHAPTER 13: CONSTRUCTING A TRANSFORMATIVE CURRICULUM VISION: PLURALISM, SYNERGY AND MONTAGE

Context Matters, Can You Suggest Some Visions For Nepali Mathematics Curriculum?

December 2008

Curriculum Planning Office

Block D, Indranagar

Kathmandu Nepal

Dear Bal Chandra

Was my previous letter more critical than it had to be? Thanks for your responses to my queries, comments and critiques. I have begun to realise that I can become a change agent for my own and others' curriculum practices by embracing a critical reflective attitude, a transformative vision and sustainable logics of practice. This process of becoming a change agent is confronting as I need to examine critically my own beliefs, values and actions. Nonetheless, the present dualistic approach to becoming a change agent is more painful than such a transformative approach because dichotomising self and other leads to maintaining a status quo. And, the status quo does not take us anywhere. Yes, I agree with you along these lines.

To act inclusively with others is quite challenging in my present circumstances. As you mentioned in the previous letter, the Curriculum Planning Office is a system guided by mimetic, dualistic and hierarchical leadership practices. Yes, I can have a transformative vision and I can make differences little-by-little. It may be the case that my small effort submerges in this giant sea of hierarchy and hegemony. You may agree with me that as educators and curriculum workers we abide by the ethics of care because many students' present and future lives depend on us. If we are able to introduce a mathematics curriculum that has transformative potential, many students will be able to enjoy the fruit of meaningful learning, critical thinking and lifeworlds-

oriented mathematics education. Cannot we propose a potentially transformative vision by which to design and implement the mathematics curriculum?

Whilst developing such a model, I would like you to clarify some important issues. In your response to my first letter, you critiqued the existing worldview that orients the mathematics curriculum towards being hegemonic and static. In your response to my second letter you seem to have indicated ways in which an alternative worldview might be different from the Western Modern Worldview. However, it is not very clear to me how I can translate it into an aspect of a transformative vision of designing and implementing the mathematics curriculum. If I understand correctly, you have indicated the need to formulate an inclusive worldview that helps design and implement the mathematics curriculum in an inclusive and transformative way. How can such a model be developed? Who will benefit from such a model? What is likely to be the key constituent of such a model?

Another perspective which confuses me is your notion of culturally contextualised mathematics education. I sympathise with you that a culturally contextualised mathematics education is essential for our students to understand the connection between their lifeworlds and mathematics. But sometimes it can be counterintuitive to people who think that the notion of 'culture' represents backwardness and status-quo. Could you please articulate more clearly how the concept of culturally contextualised mathematics education contributes to developing an inclusive curriculum?

Dear Bal Chandra, as you have noticed by your involvement in revising the Essential Mathematics Curriculum as a Curriculum Committee Member, the Curriculum Planning Office puts emphasis exclusively on the image of curriculum as subject matter. Even after reading your second letter, I am still confused about ways in which to incorporate different curriculum images in the process of designing and implementing the mathematics curriculum. Probably it is my short-sighted view, but I sometimes think that these different curriculum images appear to be academic. In what ways can the images of curriculum as currere and experience (and other images, if there are any) be translated in designing and implementing the mathematics curriculum? Can you clarify my illusion whether or not the image of curriculum as an agenda for social reconstruction is more ideology-laden than others?

Section Five

In this way I come to the final part of my letter. Do my questions make good sense to you? Hopefully, you will respond to my questions in a way that I can apply them in my professional practice. Am I asking too much in one letter?

Sincerely yours

Curriculum Officer

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January 2009

10023 Far Out Street

Mother Goddess Town

Dear Curriculum Officer

I am feeling relieved that we are able to resolve some of our disagreements. Nonetheless, I do not prefer to have, nor do I believe in, a disagreement-free communication and collaboration. Indeed, healthy disagreement is always helpful for a creative-constructive journey of transformation. Reflecting upon my professional situatedness, I disagree with myself on several occasions, especially when I have to link my academic life with my spiritual values and beliefs of egolessness arising from Eastern wisdom traditions (Brainard, 2000; Panda, 1991). But I have realised recently that such contradictions and disagreements provide us (you and me) with authentic sources for personal-professional renewal (Granger, 2006). In my mind, neither should the design space of mathematics curriculum be a disagreement-free space; rather it should invite many disagreements, antagonisms and adversaries as a basis for continuous renewal of inclusive curriculum visions.

With these views in mind, I am going to explore ways to construct an empowering curriculum vision that can help us (you and me) transform the mathematics education of Nepal from an elitist and exclusionary activity to an inclusionary and synergistic endeavour. In this process, I will begin my envisioning with three empowering theoretical referents: (a) ecological consciousness, (b) complexity science, and (c) Integralism. Refraining from using such perspectives as 'capital T' Theory, I prefer to use them as heuristic tools ('small t' theory) for envisioning an inclusive mathematics curriculum. Have you ever considered that such inclusive worldviews and perspectives need inclusive ways of thinking and expressing, especially if we are to fully utilise their potential in turning mathematics education into an inclusive and transformative enterprise? Thus, my discussions on the transformative potential of alternative-inclusive logics and holonic language will lead to an articulation of an inclusive meta-image of *curriculum as montage* which can be a basis for conceiving empowering design and implementation spaces of mathematics curricula that use a structure and agency dialectic with a view to harnessing the empowering aspects of Schubert's (1986) various curriculum images.

Inclusive Worldviews and Visions

a) Ecological consciousness: Dear Curriculum Officer, I have envisaged that we can use the referent of ecological consciousness so as to conceive an inclusive vision of mathematics curriculum that provides a basis for accounting for knowledge systems arising from local cultural practices of people. The notion of ecological consciousness is about acknowledging the rightful co-existence of humans and the non-human aspects of Nature, thereby realising inseparable relationships between Nature's different forms of lives (Zhang, 2006). Furthermore, it also includes a non-possessive attitude of humans toward Nature because possessiveness promotes aggression, jealousy and unwanted competition (Meijun, 2001). Growing up in rural Nepal, I have experienced that various cultural and religious practices of Nepali people regard *Nature as carer and preserver*, rather than a thing to be exploited by humans, an alternative view that can be antidote to the Western Modern Worldview (Bajracharya & Brouwer, 1997). Here, my notion of worldview is taken to depict a dynamic-coherent structuring of our lived experiences which offers us a basis for viewing, knowing, valuing, being, imaging, imagining and envisioning the world around us (Leddy, 2000). Perhaps, you agree with me that a large section of Nepali cultural beliefs and values arise from the view that the existence of all living beings is just as necessary and reasonable as that of human beings. Perhaps, such a notion of ecological consciousness is the key feature of the Nepali Cultural Worldview, a collective expression of the multicultural reality of Nepal, which is constitutive of Vedic, Buddhist and Animist ecological traditions (Prime, 2002; Tucker & Williams, 1997). Metaphorically speaking, the ecological consciousness-inspired Nepali Cultural Worldview promotes the view that a human life is not simply a depiction of one 'secluded' or independent life, rather it is the embodiment of many lives, as we live in a web of nurturing that supports non/human aspects of Nature (Alcazar, 2007; McHugh, 2004). Having ecological consciousness as its defining feature, I have envisaged the Nepali Cultural Worldview to be oriented by logics that promote interdependence, inclusivity and human-Nature interactivity (as opposed to human supremacy over nature). You may agree with me that the logics embedded in the Western Modern Worldview are not sufficient to express such complex relationships. In my mind, dialectical, metaphorical and poetic logics can be helpful for articulating inclusive, interactive and aesthetic aspects of human-Nature relationships (see Section Four). For instance, dialectical logic helps us integrate sometimes opposing views, attributes and phenomena similar to the view that ecological thinking promotes co-existence of pre-determined and emergent, ordinary and unexpected, order and chaos, and materiality and spirituality. Similarly, metaphorical logic helps us express the nature of embodied knowledge and wisdom that we (human beings) acquire through our interaction with Nature. In my view, poetic logic helps conceive and express aesthetic, ineffable, mysterious and sacred features of Nature which help us conceive human knowing as soulful, embodied and *contextual*. I shall elaborate these logics and their usefulness for conceiving a transformative curriculum vision under the topic of additional-inclusive logics of this chapter.

I argue here that ecological consciousness embedded in the Nepali Cultural Worldview provides us with a much-needed referent for developing inclusive and empowering curriculum visions for a culturally contextualised mathematics education that helps us incorporate knowledge systems arising from everyday cultural practices of people. To develop such visions, an important task of curriculum workers is to develop a framework that helps them to incorporate empowering knowledge systems woven in people's cultural practices.

Guided by the view that all culturally woven knowledge systems do not necessarily qualify for being incorporated into the mathematics curriculum, I suggest holding a *postcolonial cultural* view[76] in order to examine diverse traditional knowledge systems and practices for their potential role in inculcating critical and active citizenry via mathematics education and to avoid a narrowly conceptualised notion of *native(ity) as fixed and unchanging* (Ahluwalia, 2005). Taking ecological consciousness as a referent, I argue here that a three-fold principle can help us develop a frame of reference for including diverse local ecological knowledge systems in the mathematics curriculum: (1) every potential local knowledge system needs recognition; (2) local knowledge systems which are potentially useful for promoting a justice-oriented, egalitarian and democratic society should be incorporated into curriculum practices (UN, 2000); and (3) meaningfulness (i.e., relevance for and applicability to the life-worlds of learners) is a key epistemic principle for re-contextualising local knowledge systems for incorporation into school mathematics curricula (Luitel & Taylor, 2007).

b) Complexity science: Dear Curriculum Officer, you might have heard curriculum officers and experts often rhetorically mentioning that they need a scientific method or model for developing the mathematics curriculum. As I mentioned in my first letter included in the chapter, Unpacking The Trivia Of Exclusive Modernist Curriculum Practices, the idea of scientific 'models' and 'methods' are often taken to promote a one-sided view of science that promotes an equilibrium view of reality, just as the orienting assumptions of the Newton's Laws of Motion regard the world around us as unchanging and stable. In my second letter included in the chapter, Apprising My Role As A Curriculum Committee Member: Making Sense of Situatedness, I have briefly mentioned ways in which we can overcome such a one-sidedness by taking on board complexity science as a referent for conceiving the notion of curriculum as a complicated (as opposed to simpler and simplistic),

[76] A postcolonial cultural view is described by the notion of culture as emerging activities that produce meanings as opposed to culture as a fixed and unchanging entity (Schech & Haggis, 2000). Such a view of culture is believed to be empowering because of its holistic view of self, other and society, and has the potential for being used as a referent for culturally contextualised mathematics and science education for postcolonial-transitional societies.

discursive (as opposed to concise) and multifaceted-recursive (as opposed to mechanical algorithmic) praxis (Doll, 2008).

In this way, I have come to know that complexity science challenges radically the Newtonian agenda of explaining the world around us through exclusively (a) simplistic, (b) deterministic, (c) reductive, and (d) linear relationships between different constituents of the system as if such explanations are certain, final and infallible (Waldrop, 1992). Whilst challenging the Newtonian image of *reality as the state of stable equilibrium*, complexity scientists (e.g., Prigogine, 2003) argue for a worldview that accounts for the ever-changing nature of reality. On the basis of my recent exploration, complexity science refers to (a) a set of worldviews ingrained in the view of the ever-changing, emergent, somewhat open and *complicated* nature of reality, (b) a constellation of epistemologies that promote actor-involved, non-reductionist ways of knowing, and (c) logics that promote holistic, systemic and 'simultaneity' thinking (Davis & Sumara, 2006). Here my notion of simultaneity thinking refers to non-linear thinking in which sometimes opposing constructs occur simultaneously.

Taking complexity science as a key referent for the development and implementation of mathematics curriculum, we can perhaps persuade the Curriculum Planning Office to move forward teacher- and school-developed mathematics curricula, especially when attending to these features of complexity science: autopoiesis (self-producing potentials of teachers and learners), emergence (appearance of constructs, ideas, activities, phenomena in the teaching-learning process) and contextualisation (relating mathematical knowledge to time, space, person and events), which I have discussed in my second letter. In a nutshell, these three features help us to: (a) conceive and design the mathematics curriculum to maximise students' and teachers' creativity; (b) make use of a flexible and emerging socio-cultural structure in designing the curriculum so as to be inclusive of emerging knowledge systems; and (c) argue for a contextualised mathematics education that offers students opportunities to make sense of mathematics from their lived experiences.

Another helpful feature of complexity science is the notion of disorder or entropy (Prigogine, 1997) that brings a much-needed dynamism to the curriculum design space[77]. In what ways can we incorporate disorder in the design space of the mathematics curriculum? It may sound counterintuitive but these three possible ways can help incorporate the 'omnipresent but neglected disorder' in designing and implementing the mathematics curriculum. First, rather than preparing all-finished curriculum documents by the Curriculum Planning Office, each school is given some degree of autonomy in deciding certain aspects of the mathematics curriculum. Second, the Curriculum Planning Office provides a national basis for the mathematics curriculum and school districts become responsible bodies for curriculum planning at a local level. Third, let's dissolve the Curriculum Planning Office and let each school decide (auto-produce) its own curriculum on the basis of local, national and *glocal* priorities[78]. Here, the term 'glocal' refers to a synergistic space that is created by simultaneous, conflated, reflexive and interactive relationships between global and local spaces (see Section Six).

c) Integralism: Curriculum Officer, the notion of Integralism[79] has a long history in the Eastern wisdom traditions, mainly in Vedic and Buddhist traditions. Various Vedic philosophical schools, since their inception, seem to put emphasis on the unification of mind, body, soul and cosmos as a basis for liberating human lives from the cycle of birth and death (Aranya & Mukerji, 1983). Furthermore, you may realise that Vedic 'fire' rituals have been constructed in artfully integrated ways to make

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[77] I have talked about this concept briefly in my second letter. There I have mentioned embracing disorder to articulate curriculum practices in inclusive ways.

[78] Recently (December, 2008) I met a Swiss teacher educator who has been working in Nepali schools on behalf of a Switzerland-based INGO. He made an interesting revelation that the Swiss government has neither Ministry of Education nor a department responsible for designing and implementing the curriculum. It is all 25 or 26 school districts which design and implement the curriculum in their respective schools. At that time, I thought that this can be an excellent 'radical' example that can be used to contest the restricted view of what is possible in education. For me, such a model can be a referent for thinking about accounting for disorder or entropy in designing and implementing the curriculum.

[79] In Section Zero of this thesis, I have discussed the paradigm of Integralism as a basis for generating synergistic and holistic views of knowing. Here, I use a similar aspect of Integralism in relation to developing a transformative curriculum vision.

offerings to both so-called divine and devil attributes of the cosmos (Mahony, 1998). In Buddhist traditions, one-sided extremism has always been discouraged, thereby embracing a middle way (dialectical way) as a basis for articulating the interconnected nature of humans and non-humans and lives and non-lives (Habito, 2007). In modern times, Sri Aurobindo appears to have demonstrated through his practice and writing that our 'being' comprises differing (sometimes opposite) attributes (Sri Aurobindo & McDermott, 2005). Recently, Ken Wilber has proposed a four-quadrant model that promotes integrating self, culture, science and system. Known as *all-quadrant-all-level* (AQAL) model, it comprises autobiographic-subjective, cultural-intersubjective, scientific-objective and social scientific-interobjective knowledge systems as possible ways to interpret our experience about the world *within* and *outside* of us (Wilber, 2001a). Tentative as it may be, Wilber's model offers a way of integrating sometimes opposing and complementary knowledge systems embedded in Wisdom Traditions arising from the Western Modern Worldview, and generated by the postmodern upsurge in social and cultural studies of human sciences (Walshaw, 2004a). Conceiving it from a different perspective, I have come to know integralism (adapted from Gunnlaugson, 2004; Wilber, 2007) as (a) a philosophy that brings some degree of coherence dismantled by the anarchy of deconstructive postmodernism (as opposed to constructive postmodernism (Shea, 1998)), (b) a worldview that incorporates both the pre-modern notion of *spirituality* and the modernist view of *materiality* , (c) an epistemology that goes beyond the duality of modernist 'Objective Truth' and postmodernist 'subjective truths', and (d) a logical system that recognises the potential of post/formal logics[80] (Wilber, 2000d) for conceiving inclusive visions of anything, including that of the mathematics curriculum. Here, my idea of post/formal logics includes those logics which promote inclusive and synergistic thinking and actions. Furthermore, post/formal logics provide us with a referent to go beyond formal structures, systems, methods and algorithms, thereby embracing much needed

[80] Such logics are different from what Piaget articulated as formal logics arising from hypothetico deductive thinking (see Section Zero, Section One and Section Four of this thesis). According to Wilber, postformal logics are a means for promoting holistic, complex and 'vision' thinking.

contextual, creative, imaginative, embodied and futuristic thinking to address problems and issues of our professional lives. Whilst formal logics restrain us using porous, interpretive and layered language, post/formal logics offer ways to express complex, sometimes contradictory, ineffable and implicit ideas through unconventional means of representation such as narrative, poetic, visual and dialogic genres.

In this way, Integralism opens a new vista for us in creating potentially an integral space for generating a synergy between the Western Modern Worldview and the Nepali Cultural Worldview to empower students to fully utilise the benefits of having differing knowledge systems in their mathematics curricula. The image of synergy-making as a constant interplay between worldviews gives rise to a view that 'every*thing*' (including the mathematics curriculum) is ever-changing (Basseches, 2005). With the help of Integralism we can argue that emerging dialectics between the Western Modern Worldview and the Nepali Cultural Worldview can develop a transformative curriculum vision, thereby softening the unhelpfully rigid borders created by many dualisms, such as global versus local, Western versus Eastern and pure (arising from the view of *mathematics as a pure body of knowledge* and constitutive of decontextualised, symbolic, abstract, algorithmic, formal) versus impure (arising from the view of *mathematics as an impure knowledge system* and constitutive of embodied, informal, artefactual, ethnic) mathematics. By this process, we can persuade our colleagues and teachers to shift from the age-old dualistic goal of mathematics education as delivering *coming-from-nowhere-content* to a mathematics education that is ecologically responsible, holistic and accountable to local cultural practices.

Next, another suspicion (and resistance) can arise from proponents of the longstanding view of *mathematics as a body of pure knowledge* (e.g. Rowlands & Carson, 2002), which seems to view our ensuing perspective of culturally contextualised mathematics education as being narrowly constitutive of the view of *mathematics as an impure knowledge system* (see Section One). Rather than advocating a particular pole of the dichotomy of 'pure' and 'impure' mathematics, I am using the qualifiers of culture and contextualisation to challenge the widespread hegemony of culturally decontextualised mathematics embedded in the mathematics curriculum that privileges the singular view of the nature of mathematics,

mathematics as a body of pure knowledge (see Section One). Therefore, I am not suggesting that we promote yet another hegemony, that impure mathematics becomes superior to pure mathematics. In this connection, I believe that Integralism offers us ways to overcome prevailing one-sidedness and partiality by integrating sometimes antagonistic perspectives, phenomena and concepts, thereby giving rise to multidimensionality, synergistic dynamism, and personal practical wisdom as empowering constructs for transformative curriculum visions. The idea of multidimensionality helps present a holistic picture of events, phenomena and conceptions under consideration. Thus the visual image of multidimensionality can helps us represent Many views of the nature of mathematics as being interconnected and interrelated facets of the One. The characteristic of synergy can help us play the role of an alchemist who makes meaningful and transformative mixes out of sometimes adversarial, antagonistic and complementary ideas (Wong, 2006). As curriculum workers our main challenge is to create empowering and meaningful synergies between different views of the nature of mathematics, such as *mathematics as a body of pure knowledge*, *as an impure knowledge system, as absolute knowledge, as a multi-semiotic discourse*. In a similar vein, the third key feature, practical wisdom, helps each curriculum stakeholder to use both his/her heart and mind to contribute to the development and implementation of an inclusive mathematics curriculum. Furthermore, practical wisdom helps curriculum workers work for constant improvisation by inventing context-appropriate combinations that help conceive visions for developing and implementing an inclusive mathematics curriculum.

Dear Curriculum Officer, I envisage that we will encounter yet another question whilst designing and implementing mathematics curricula: *Which one do you prioritise, contextualism or universalism?* Here, my notion of contextualism refers to ways of incorporating contextual knowledge systems, pedagogic models, and experiences in the design and implementation spaces of the mathematics curriculum (Camp, 2006; Taylor et al., 2007). Similarly, universalism appears to be associated with colonialist discourse and is taken to explain the view that the mathematics curriculum is developed in the same way everywhere irrespective of contextual variations (adapted from Rizvi, 2007). Perhaps, it is because of the narrow and one-dimensional visuality of the Western Modern Worldview, which is hegemonic in their consciousness, that our colleagues, co-workers and seniors may find it hard to accept that sometimes opposing ideas and views can stay and co-act together. Whilst arguing in simple terms we can say that: *we need both ways of knowing so our curriculum should integrate both universal*[81] *(inspired by the Western Modern Worldview) and contextual (inspired by Nepali the Cultural Worldview) knowledge systems*. Whilst arguing with sophistication, we can say that: *universalism and contextualism are merely labels and we attach meanings to them according to our standpoints and levels of consciousness. So it is unhelpful to privilege one type of thinking over the other.* Arguing from this perspective, contextualism versus universalism is a result of an unhelpful dualism which does not help conceive an inclusive mathematics curriculum because any form of dualism has a tendency to privilege one particular polarity of the dichotomy.

Additional-Inclusive Logics

Dear Curriculum Officer, in my first letter I have critiqued key orienting logics of the mathematics curriculum of Nepal. And, in the second letter, I questioned your somewhat exclusive and disempowering logics of practice. Perhaps, these critiques are compelling me to propose inclusive ways of thinking and sensemaking of omnipresent complexities, adversaries and antagonisms in the process of designing and implementing the mathematics curriculum. If we are to fully realise the potential of the Nepali Cultural Worldview, complexity science and Integralism in designing and implementing the mathematics curriculum, we need to unpack logics that underlie inclusive and synergistic thinking.

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[81] As I have said that universalism is associated with colonialist discourse, you may raise a question here: Why are you promoting this colonialist discourse then? I hold the view that colonialism may not be that bad altogether as we (at least me) are constantly colonising our 'body-mind sphere' by others' ideas and concepts. Furthermore, it is hard for me to declare myself as solely a 'colonised being' because, as a teacher educator, I am always in the position of colonising others (albeit positively) via my ideas, ideologies and worldviews.

Although I have come across different forms of dialectics (Wong, 2006), the main purpose of dialectical thinking is to minimise contradictions imbued in 'either or' dualistic logics (see Section One). For instance, while embracing the view of *mathematics as pure knowledge* (culture-free, disembodied, symbolic, algorithmic) we might ignore the so-called opposing view of *mathematics as impure knowledge* (culture-laden, embodied, informal, artefactual) without which *mathematics as pure knowledge* does not make the fullest possible sense, just as the concept of light does not make sense without the concept of dark. My recent exploration of culturally ingrained dialectics (Section One; Wong, 2006) can help us realise the transformative power of dialectical thinking more than I had envisioned initially. While synthetic and dialectic views embedded in early Vedic traditions indicate the possibility of amalgamation of opposites so as to generate an holistic perspective of the world (Sri Aurobindo, 1998), negative dialectics (the logic of *neither nor*) (Raju, 1954) embedded in the Advaita Vedanta tradition of Hinduism and dialectics arising from the dependent co-arising logic of the Madhyamika tradition of Buddhism can allow us to move beyond two opposing views of the nature of mathematics. Viewed from an Advaita-Vedantic perspective, neither *mathematics as pure knowledge* nor its negation (i.e., mathematics *as impure knowledge*) constitute the true nature of mathematics; rather there is something beyond (or prior to) these two which can help us realise the comprehensive-holistic nature of mathematics. Contextualising Nagarjuna's dialectic (of Madhyamika Buddhism) also helps us realise that every concept is co-arisen by its dependent opposite, thus leading to emptiness. Nagarjuna's view is quite helpful for us to critique the dualistic-essentialist view of anything including views of the nature of mathematics it-self, for the notion of 'self' is understood in terms of 'other' (or non-self) and *vice versa*, leading to both of these concepts presupposing each other and neither having a permanent essence.

Dear Curriculum Officer, perhaps you may know from my previous letter that metaphorical thinking promotes open and embodied inquiry for exploring multiple facets of knowledge and knowing. Metaphor can provide us with a great deal of openness for understanding a phenomenon, especially when a simplistic definition is not able to capture the complexity associated with it. It can be this logic that transcends narrow literalism by making use of images and imageries, which I have used to articulate different images of curriculum in this and previous chapter.

Furthermore, throughout Sections Two, Three and Four of this thesis, I have used images, imageries and similes to explore the meanings of concepts under my inquiry (Weber, 2008). While metaphorical thinking allows us to operate beyond the propositional logic frame, it also offers a platform for thinking and acting through many 'as-thoughs' in order to minimise the extreme essentialism imposed via the hegemonic images of mathematics curriculum that are oriented by a dualist-modernist perspective. Here, essentialism is associated with narrow literalism that regards words and sentences as un-alterable objects (Cupane, 2007).

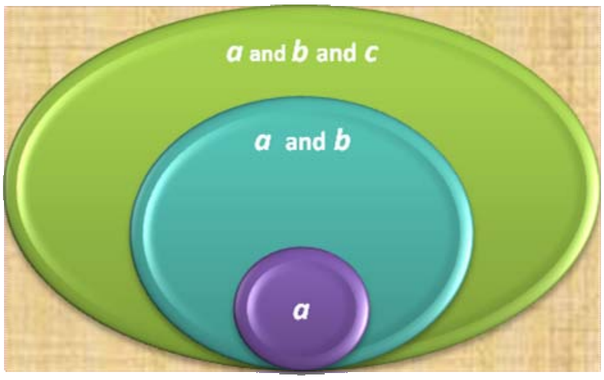
> Let's
>
> Let's encourage me as a mathematics teacher
> To speak from my heart
> To tell the truth of who I am
> To allow them to explore their identity
> To link between the word and the world
>
> Let's encourage me as a mathematics teacher
> To know what I don't know
> To admit what I don't admit
> To share what I don't share
> To realise what I can and cannot know
>
> Let's encourage me as a mathematics teacher
> To treat my students as human beings
> To regard my students as self-ful persons
> To fulfil a yearning for knowing, being and valuing
> To see hopes and possibilities in every student

Finally, drawing from mytho-poetic traditions (Fleener, 2005), I say to you that poetic logic helps us reach toward the unreachable (or ineffable) via a normal academic-language structure. Unlike reductionist logic which restricts us from seeing multi-dimensional reality that is required for generating inclusive visions for designing and implementing the mathematics curriculum, poetic logic helps us experience nonreal, envisioned, and atypical reality. Bringing this logic into the design space of mathematics curriculum requires us to unpack the prevailing academic language game that promotes propositional-analytical logic which prefers clean (not messy), linear (not nonlinear) and unequivocal texts via the interlocking system of academic training, research and productivity. We can explore many culturally woven poetics being potentially useful for generating empowering curriculum visions that can promote a meaningful and transformative mathematics education. Epistemologically, this form of logic can be useful for introducing nonlinearity, silence, emergence, melody and meter, all of which can be useful for developing an holistic understanding of the world around us. In bringing sometimes contrary views of the nature of mathematics together in the curriculum design space, poetic logic can play the role of alchemy by mixing unthinkably differing (in terms of normal academic textual representation) views to produce empowering curriculum visions.

Holonic-Inclusive Language

Dear Curriculum Officer, I am moving toward yet another conception, holonic-inclusive language (Floyd, 2008), which can help us facilitate the process of curriculum design in an inclusive way. Now, you might have begun to notice the importance of language for articulating and communicating our inclusive visions of developing and implementing the mathematics curriculum because language is constitutive of reality. If we are to fully realise the potential of inclusive, interconnected, ecological logics in conceiving transformative curriculum visions, we need such a language that helps embody inclusive and relational thinking (or logics) and expressions through our actions. What type of language helps us conceive, embody and express inclusive and relational thinking and actions? I now begin to feel how our curricular practices affect (or are related with) a large group of people, for as the Buddha says: *what others are because of you*. In these days, Network Theory emphasises the phenomenon of the interconnectedness, interdependence or relational nature of people of different parts of the world as a means for a sustained solution to many problems including the spread of dangerous disease (Gummesson, 2007). The ancient wisdom of the East and the recent discoveries of the West pinpoint a paradigm shift which requires us to depart from the conventional language of dualism and hierarchy, thereby embracing an inclusive and holonic language that promotes the relational nature of sometime opposing ideas, attributes and concepts. However, my use of East and West is largely metaphorical and I do not intend to claim that the entire East is necessarily homogeneous and nor do I make the same claim about the West.

In my mind, a holon can be equated with a system that is both a whole in itself and a part of a larger system which includes itself (Wilber, 1996). Thus, a holonic language can help us express in an inclusive, interconnected and interactive way that accounts for the emergent and layered nature of language. In expressing inclusively, our tendency is to include perspectives and ideas of people who may not agree with us. Holonic language can serve as a means of persuading people to accept some aspects of our ideas. We may not expect that our co-workers, collaborators and colleagues necessarily accept what we propose. Thus, we may be able to practice various forms of interactivity, combinations and simultaneity that lead to transformative vision-making for designing and implementing an inclusive mathematics curriculum.



Curriculum Officer, holonic language can provide opportunities to bring alternative-inclusive thinking to spaces of designing and implementing mathematics curricula, thereby helping us to transcend conventional perspectives of curriculum by empowering visions. In such a transcending, conventional perspectives become part of the new vision. Rather than being a visual source of an exclusive hierarchical approach to articulating ideas about curriculum, holonic language transcends both hierarchical (i.e., top down) and heterarchical (i.e., bottom up) approaches (Kupers, 2008). Don't we need this kind of vision to create a democratic space in which the Curriculum Planning Office and schools come together to create a dynamic and inclusive mathematics curriculum?

Multiple Curriculum Images and the Meta-Image

Dear Curriculum Officer, I have mentioned in my second letter that an empowering approach to viewing the notion of curriculum lies in using different metaphorical images. In that letter, I articulated five key curriculum images (i.e., *curriculum as subject matter, discrete tasks and concepts, an agenda for social reconstruction, planned programs and activities, and intended learning outcomes*) proposed by Schubert (1986). Let me briefly articulate three remaining curriculum images. In so doing, I do not intend to impose Schubert's view upon other curriculum workers; rather my intention is to use his available ideas to demonstrate our vision of managing sometimes adversarial curriculum images. Indeed, we can also construct our own curriculum images so as to capture the contextual uniqueness of our schooling, teaching and learning.

Let me start with the image of *curriculum as cultural reproduction*. Have you heard of this image before? In my mind, this image of curriculum can exert both negative and positive influences on the pedagogy of mathematics. The negative aspect is associated with its high fidelity to the reproduction of unhelpful hegemonies, hierarchies and false consciousness (Apple, 2004). It can also be associated with the mathematics curriculum that tends to legitimate a particular form of language, logic and perspective. Cannot this be regarded as a tendency to reproduce (and legitimate) a particular type of dominant culture by using mathematics curricula? On the positive side, we need to value, legitimate and reproduce certain cultural practices which are part of our students' day-to-day living. I hold the view that we need to promote a critical or reflexive or mindful conservatism that helps preserve empowering traditional cultural practices through our transformative curriculum vision (drawing from Bowers, 2003). For example, students in rural Nepal engage in cattle grazing, grass cutting, paddy plantation and other household chores. Should the mathematics curriculum not account for Nature-caring activities and aim to reproduce the culture of being respectful of the hard work of village students?

> Musing
> How can I contact an object?
> I better try to expand myself.
> How can I get help from my neighbour?
> I better start lending my favour.
> How can I take something from someone?
> First I give him/her the same.
> How can I know my rights as a person?
> First, I better learn to be a responsible being.
> How can I include my voice?
> I better incorporate others first.

Next, Schubert's image of *curriculum as planned programs and activities* is likely to help defrost the subject matter in macro, meso and micro levels of planned activities. Although the question of 'who' is very important whilst developing planned activities, this mathematics curriculum image is likely to provide venues to translate curriculum objectives, outcomes or goals into classroom activities. You may agree with me that this curriculum image can potentially be disempowering if planned programmes and activities are meant to be exclusively imposed by the Curriculum Planning Office without paying any attention to serving the broad interests of learners. On the other hand, such an image of curriculum can be helpful for incorporating local contexts and knowledge systems, if programmes and activities are worked out by teachers (and students) according to their local and global (or glocal; see Section Six) needs.

You might have heard the buzzword 'outcome' in various seminars and discussions that you have attended as a curriculum officer. Schubert makes use of such a buzzword to construct another image of *curriculum as intended learning outcomes*. Perhaps, it is due to the situation that education was strongly influenced by psychology in the early part of the 20th century. Therefore, educational activities (including curriculum) might have been considered since then to be a domain of intentionality (Hilgard & Bower, 1977). Of late, the concept of narrow intentionality has been questioned as many unintended outcomes are unaccounted for in the process of learning and teaching (Jackson, 1968). Nonetheless, I hold the view that not all intentions are bad inasmuch as they serve the broader interests of learners. Incorporating aspects of the image of *curriculum as intended learning outcomes* into the mathematics curriculum can promote both mimetic (i.e., transmissive, reproductionist) and transformational (i.e., structural shifting, going beyond) curricular opportunities. For example, outcomes that demand the reproduction of mathematical concepts and ideas are likely to be depicted as mimetic outcomes whereas outcomes that promote critical, reflective and imaginative thinking can be regarded as transformative. Do you think that transformative outcomes prevent mimetic outcomes from being incorporated in our curriculum vision? In my mind transformative outcomes are inclusive of, but not limited to, mimetic outcomes.

Although utilising these alternative ways of thinking and expressing, we need to remain aware that the widespread, yet strategically hegemonic, view of *curriculum as subject matter* continues to supersede other images of curriculum, especially *curriculum as agenda for cultural reconstruction, curriculum as experience* and *curriculum as currere.* As a response, I have developed a multi-perspectival image of *curriculum as montage* for emancipating learners from the one-dimensional view of *curriculum as subject matter*. The term 'montage' derives from cinematography where it means to embody an unconventional approach to editing images (Reid, 2005). The idea of montage is famous for disrupting the longstanding realist and formalist approach to creating pictorial representations of the social and political world by juxtaposing unrelated shots and images, thereby generating layered visual understandings of the world. The image of *curriculum as montage* can help us create a legitimate space for a contextualised mathematics education that takes into account cultural and spiritual multiplicities offered by the Nepali Cultural Worldview. Thus the montage image offers a great deal of potential for incorporating multiple knowledge systems arising from diverse cultural and spiritual traditions, thereby accommodating sometimes opposite views of the nature of *mathematics as a body of pure knowledge* and *mathematics as an impure knowledge system*. It involves a dynamic adaptation of multiplicities, as a complex and cosmological act, for nurturing learners' layered and multifaceted personalities (Doll, 2005; Pinar, 2003; Sri Aurobindo & McDermott, 2005).

Structure and Agency Dialectic

Dear Curriculum Officer, you may still be unsure about how I am going to present a coherent model (or something like that) for designing and implementing the mathematics curriculum. Indeed, I don't want to claim it as a capital M Model; rather I want to use this as 'small m' model which is very much heuristic and contextual. Thus, you are welcome to refine and adapt the model according to our needs provided that the adapted model still underlies a transformative curriculum vision that incorporates sometimes opposite and varying images of curriculum. In my mind, such an inclusive vision is guided by inclusivity rather than the exclusive logic of dualism and reductionism. There may be many such visions, but I find the structure and agency dialectic helps me to cohere sometimes opposing curriculum images so as to develop inclusive and empowering visions of curriculum.

The perspective of the structure and agency dialectic can help unite both structural and agentic aspects of curriculum images. But first, let me explore briefly meanings of structure and agency. The idea of structure is associated with schemas, rules and overarching patterns present in people's consciousness that are believed to govern people's actions. Whilst paying attention to the ongoing debate (Sewell Jr, 1992) on what counts as structure, I have come to realise that the term 'structure' refers to a range of ideas (inasmuch as I am aware), such as social systems and cultures, rules and schemas, human and non-human resources[82], and generalisable and contextual procedures. Perhaps, you agree with me that in the case of development and implementation of mathematics curriculum, the curriculum development procedures, the official curriculum document and the prescribed textbooks can be considered as structure. Moreover, the curriculum images (e.g., curriculum *as subject matter*, as *discrete tasks and concepts*), which put emphasis on reproducing a normative cultural pattern, seem to promote exclusively the *a priori* formal structural aspect of the mathematics curriculum, thereby neglecting the vital role of contextual and personal creativity in its implementation. In my mind, the notion of agency is associated with actions performed by individuals and groups with a purpose to question, challenge, resist, or oppose the hegemonic normalcy of the given order (Willmott, 1999). For me, agency-oriented curriculum images are likely to put emphasis on learners' creativity, thereby offering opportunities to challenge hegemonic pedagogical practices.

Although it may seem that structure and agency form an inescapable dualism, I envisage that these two constituents embedded in any system presuppose each other dialectically. Even though agency gives rise to pedagogic actions, such actions appear to form new structures. In a similar way, empowering pedagogic structures give rise to actions that may help to cultivate the agency of learners. Thus, a curriculum structure of any sort (i.e., subject matter-based, concepts and tasks-based, or outcomes-based) may not make the fullest possible meaning without the aspect of agency which is a much needed ingredient ensuring the creative and empowering enactment of the curriculum structure. Thus, I envisage that using dialectical logic to reconceptualise the relationship between structure and agency can help us transform the widespread dualism embedded in the traditional view that curriculum designing

[82] The notion of human resources accounts for virtual and cognitive type structure mainly embedded in our thinking, whereas non-human resources appear to be allocative materials existing as non-virtual objects.

is attributed to imposing a structure whereas implementation of the curriculum is reproducing the prescribed structure without any form of creative and agentic alteration. With the help of dialectical logic we can realise the unseen presence of the dependent co-arising relationship between structure and agency, meaning that curriculum structures give rise to different forms of agency *and vice versa* (Elmesky, Olitsky, & Tobin, 2006).

Having such a dialectical perspective at our disposal, we can relate structure-oriented curriculum images with those of the agency-oriented images so as to articulate inseparable, simultaneous arising, complementary and interconnected relationships between structure and agency-oriented curriculum images. In my mind, images of curriculum, such as *subject matter, planned activities*, *intended learning outcomes, discrete tasks and concepts* are considered to represent the structure of the curriculum, thereby offering teachers and curriculum workers ways to incorporate different knowledge systems in the mathematics curriculum. In a similar way, images of curriculum, such as *curriculum as currere, experience, cultural reconstruction and cultural reproduction* are taken to represent the agency aspect of the curriculum.

I believe that the agency of learners (and teachers) cannot be enhanced and facilitated well without a structure that is self-organising (as opposed to structurally stagnant), auto-adaptive (as opposed to defensive) and self-reflective (as opposed to self-closure), and that the enhancement of this type of structure, in turn, requires a strong sense of agency vested in teachers and learners. Thus, my argument for an emphasis on the agency and structure dialectic as an underlying logic serves the purpose of providing learners and teachers with opportunities to incorporate their imaginings into the curriculum process that incorporates students' lifeworlds in its core. The empowering idea of 'flexible control' (Aviram & Yonah, 2004) embedded in the image of *curriculum as montage* can perhaps help learners and teachers to co-generate their curriculum as a frame of reference as well as an emergent social-cultural-personal cours*ing*, an approach to viewing curriculum as an individual path-making journey. I argue, therefore, that in order to develop a transformative curriculum vision for a contextualised mathematics education we need to pay attention to the structure and agency dialectic; reconceptualising *curriculum as montage* promises a more inclusive and dynamic mathematics curriculum that can be helpful for incorporating various knowledge traditions in the day-to-day operation of mathematics classrooms. Once this curriculum meta-image is in place then we can start collaborating with teachers to develop empowering pedagogies, such as eco-pedagogy, community problem solving and active engagement (Brickhouse & Kittleson, 2006). The idea of eco-pedagogy is to establish a close bonding with Nature as well as to promote the pedagogy that promotes eco-logics (inclusive and emergent logics) of knowing, being and valuing (Afonso, 2006). Such pedagogies can potentially enhance the cultural capital of learners, thereby preparing them to develop a critical and holistic outlook (as opposed to the diminished dualistic outlook imposed by the Western Modern Worldview) on the world around them (Taylor, 2006). This can be one of several possibilities for how we can translate a curriculum vision for turning mathematics education into a transformative endeavour.

Thus, I have articulated a transformative curriculum vision with an emphasis on transforming the existing Nepali mathematics curriculum which currently does not account for diverse local cultural practices and knowledge traditions arising from students' lifeworlds. I am hoping that we can bring this curriculum vision to the design and implementation space of the mathematics curriculum. I hope that we will keep our communication channels open so as to continue our commitment to creating and nurturing a dialogic space for generating an inclusive vision of mathematics education. Until then,

Sincerely yours

Bal Chandra

FADE TO BLACK

Recapitulating the Present, Mapping the Futures

With the aim of exploring exclusionary views embedded in the modernist-inspired curriculum image (e.g., *curriculum as an object* or *a thing*) and developing a transformative curriculum vision for an inclusive mathematics education, my inquiry has identified a number of disempowering assumptions underlying the extant mathematics curriculum of Nepal. Whilst identifying key problematic features of modernist-inspired curriculum practices, I came to recognise the Newtonian view of stable reality, an absolutist view of mathematical knowledge, a non-porous view of language and a reductionist-dualistic view of mathematical thinking. More so, I realised that a mono-cultural perspective embedded in modernist-inspired curricular practices prevents knowledge systems arising from local cultural practices from being included in the mathematics curriculum of Nepal because of the hegemonic posture of modernity.

By the end of Chapter 12 of this section, I was able to grasp how inclusive thinking and actions are needed for curriculum workers who wish to transform the practices of designing and implementing a culturally inclusive mathematics curriculum. In this chapter, I have presented aspects of complexity science and multiple images of curriculum as a means for bringing transformative thinking and action to the curriculum design space. Finally, Chapter 13 portrays a number of perspectives that enabled me to construct a transformative curriculum vision with the synergistic image of *curriculum as montage*. Above all, I have envisaged that the *curriculum as montage* image is likely to be helpful for mathematics education to become inclusive of conceptual, personal, cultural, experiential, critical, imaginative and contextual dimensions of knowledge and knowing.

Section Six will focus on issues arising from my experience of formulating a mathematics teacher education program for the University of Himalaya. I will refer to the transformative curriculum vision that I have proposed here whilst envisaging an inclusive view of globalisation, an inclusive space created by the dialectics of scepticism and foundationalism, and a sustainable space of inclusive mathematics education.

SECTION SIX: 'WHAT IS OURS AND WHAT IS NOT OURS?' -- INCLUSIVE IMAGININGS OF CONTEXTUALISED MATHEMATICS TEACHER EDUCATION

Orientation

In Section Zero of this thesis I described how I encountered disempowering views of globalisation, foundationalism and mathematical language whilst formulating a teacher education program for the University of Himalaya. Arriving at the end of Section One, I envisaged the need of an inquiry into an inclusive mathematics teacher education program that incorporates the multidimensional nature of *mathematics as an im/pure knowledge system*. Whilst writing Section Two, I came to realise how a dualistic worldview privileges narrowly conceived globalisation as a basis for culturally decontextualised mathematics education, thereby giving rise to an inquiry into the issue of globalisation in relation to teacher preparation program in mathematics. Furthermore, Section Five indicated a need to envision an inclusive mathematics teacher education for upholding the transformative curriculum vision that incorporates competing interests and ideologies. Given this background, the following research questions will guide my inquiry in this culminating section:

- In what ways do exclusive views of globalisation, an extreme view of foundationalism, and a narrowly conceived view of mathematical language prevent mathematics teacher education programs from becoming an inclusive and transformative educational endeavour?
- What are likely to be key perspectives that overcome such exclusionary views for conceiving a vision for an inclusive mathematics teacher education?

My inquiry in this section is guided by four key purposes. First, I intend to explore narrow meanings of globalisation and the implications for mathematics teacher education in Nepal. My second purpose is to deconstruct the hegemony of foundationalism prevailing in the field of mathematics teacher education. Third, I aim to investigate how the hegemony of analytical language embedded in the nature of *mathematics as a body of pure knowledge* attempts to portray mathematics teacher education as an exclusive enterprise. Finally, I seek to offer inclusive, agentic and transformative visions for addressing such disempowering perspectives that are widespread in the landscape of mathematics education in Nepal.

This section of my thesis employs narrative imagination as the primary epistemic technique with some aspects of performativity (e.g., readers theatre, writing as performing, performative nature of narratives) facilitating the organisation of the section. Whilst using Tamy Spry's (2001) performative rhetoric of 'being there' and 'being here', I aim to represent my narratives of experience through the lens of performativity. 'Being there' represents 'signature stories' or 'data texts' constructed on the basis of my experiences as a teacher educator, whereas 'being here' entails subsequent interpretations of issues mentioned in the 'being there' stories with the help of my present perspectives. However, this demarcation is used only for practical purposes, as both 'being here' and 'being there' texts appear to be blurred and interdependent. In the process of generating signature stories (or data texts), *We Need A Globally Justifiable Teacher Education*, *Follow The Foundation of Mathematics Education*, and *We Should Hold Dearly Pure Mathematics And Analytical Thinking*, I construct three composite characters, Dr. Director, Dr. Authority and Professor Prescription, to represent attitudes and perspectives widespread amongst Nepali mathematics teacher educators that I encountered during the process of formulating a two-year teacher education program in 2004 and 2005. The first of the three chapters (i.e., Chapter 14: Farewell to Unhealthy Globalisation: Imagining an Inclusive Globalisation) depicts my experience of working with academic-administrators of the university whilst developing a teacher education program for secondary schoolteachers. The second chapter (i.e., Chapter 15: Deconstructing Foundationalism: Proposing a Healthy Scepticism for Inclusive Mathematics Teacher Education) presents my critical view of prevailing foundationalism that has been a restraining factor for a contextualised teacher education program. Drawing on the multidimensional nature of mathematics (see Section One), the final chapter (Chapter 16: No to Exclusionary Views: Imagining Inclusive Mathematics Teacher Education) protests the prevailing decontextualism that privileges one particular view of mathematical language. The following list of characters and their attributes can help readers understand the plot of my evolving stories and their subsequent interpretation.

Character	Description	Snapshots and roles in the Story
Dr. Director	This character represents composite attributes (e.g., Dr. Stern in Taylor, 2002) of many academic administrators (Deans, HoDs, Directors, Coordinators and so on and so forth) with whom I work. This character holds an extremely narrow view of globalisation as Westernisation and universalisation.	Dr. Director advocates adopting a teacher education model of a country where he did his PhD. He gives me some books (published in the late 60s) on educational psychology and measurement and evaluation, thereby persuading me to prescribe them as textbooks.
Dr. Authority	This character is a collective representation of mathematics teacher educators with whom I work. Dr. Authority is an uncompromising devotee of the foundation of mathematics education. His foundation comprises psychological behaviourism and conventional mathematical structure which he calls the 'logical aspect' of the foundation of mathematics.	Dr. Authority is critical of my possibly non/foundational approach to formulating a teacher education program. Dr. Authority suggests that I should not deviate from what other universities' mathematics teacher education departments have been following. He is also particular about formulating measurable unit objectives.
Prof Prescription	A 'pure mathematics professor' (he wants to be known as such) is a composite construction of mathematics professors with whom I have worked. Although he has a 'pure mathematics' background, he teaches in both departments: mathematics education and mathematics. He is very critical of pedagogical aspects of mathematics education. His buzzword is analytical language and pure mathematics.	Prof Prescription critiques my proposal as being an infidel to true mathematical thinking. He suggests that I develop those mathematics units (courses) which promote analytical language. He also critiques the inclusion of reflective practice, collaborative learning, sociocultural perspectives of mathematics education for allegedly being *un*-mathematical.
I (= Bal Chandra)	A teacher educator and researcher who would like to develop a vision of culturally contextualised mathematics teacher education. At times, he does not directly contest the hegemonic views of Dr. Director, Dr. Authority and Prof Prescription as he thinks that he can slowly and quietly transform the situation that prevents mathematics education from becoming inclusive enterprise.	In the three signature stories, Bal Chandra has been mainly a listener, who does not oppose any ideas possibly due to the prevailing hierarchy and power structure of the social system. However, he indirectly protests Dr. Director's view of using a country's teacher education system, Dr. Authority's foundationalism and Prof Prescription's analytical language.

		Throughout the 'being here' part of each chapter, Bal Chandra uses various perspectives to critique the narrow views of globalisation, foundationalism and mathematical language. In each chapter, Bal Chandra strives to develop an inclusive and transformative vision of different aspects of contextualised mathematics teacher education.

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CHAPTER 14: FAREWELL TO UNHEALTHY GLOBALISATION: IMAGINING AN INCLUSIVE GLOBALISATION

Being There: We Need A Globally Justifiable Teacher Education!

"Namaste Sir", I greet with a usual smile, "Are you available for our meeting, now?"

"Oh..., we have a meeting? I have totally forgotten of this." Bemused Dr. Director admits his forgetfulness, looking at the photocopy machine purposelessly. "Sir, I handed a document to you last week. Have you gone through it by any chance?", I persuade Dr. Director to focus on the issue that I want to discuss with him.

We do not speak for about a minute as Dr. Director looks for the document. I sit quietly, waiting for Dr. Director to find my draft proposal for launching a two-year mathematics teacher education program for secondary schoolteachers. "Well, yes I found it. I have made some notes here, by the way. It means that I have gone through it. Give me five minutes so that I can have a quick look at my notes." Unsurprisingly, Dr. Director does not wait for my permission and starts scanning his own comments.

It can be any day in the month of March 2005. Dr. Director is ready to talk about my proposal. I am sitting facing him, sharing the same messy desk that he has been using. "Well, you have worked out a structure already. Did you consult with Dr. Authority and Prof. Prescription? They both completed their advanced studies at the universities of U," speaks Dr. Director, demonstrating his age-old legacy of celebrating the country where he completed his advanced studies.

"Not yet. I am planning to develop a complete draft and make it available to relevant professionals for their comments. Cannot I share the detail of the program with Dr. Authority, Prof. Prescription and other professionals after we complete the official rituals of the University of Himalaya?", I say, with an invisible resistance to Dr. Director's view of relying on people who prefer to stick to their old guns.

We do not speak for a while. Dr. Director looks somewhat serious and so am I. Perhaps, he is busy working out appropriate language to respond to my mild resistance. I am also thinking creatively to pacify my agitating self that interprets Dr. Director favouring a bunch of professionals who completed their advanced studies at the U with a tendency to privilege a singular worldview. My agitating self keeps on asking me: Why does he favour Dr. Authority, and Prof. Prescription as there are many other professionals probably more productive than these relatively 'out of touch from reality' professors?

"I don't know which courses (i.e., units) you have done in your overseas studies. Thus, you need to outsource U-educated professionals in the team otherwise it is hard for me to forward your proposal to the relevant committees of the university. And, you should know that our department uses exactly the same 'system' used by the universities of the U. You cannot deviate from the system because quality teacher education is possible only by following a standard global system of education", Dr. Director postpones his eulogy to the system of education of U for a moment and I console my resisting self to adopt a strategy of quiet criticality.

I don't know whether Dr. Director wants me to continue our conversation or leave his office. But I don't want to leave the meeting unresolved. As Dr. Director is busy responding to a caller, I am thinking about possible permutations of words that I am going to use to respond to his narrow view of globalisation.

"Sir, what should I do then? Please, show me the way. I have no problem meeting with Dr. Authority and Prof. Prescription. Next, I am conceiving this program to be a good Nepali teacher education program that can be helpful for improving mathematics classrooms of Nepali schools rather than a program that mimics foreign models in the name of globalisation. I believe that I have acquired relevant degrees in mathematics teacher education, which help me find ways to identify key strengths and weaknesses of our mathematics education program and address them contextually. Overall, I regard myself as a learner rather than a perfect authority of the field", I offer a mild dose of criticality, as Dr. Director remains in the world of solitude.

Dr. Director does not speak for a moment, and then turns his chair toward the cupboard where he has kept some 10/12 books, which he shows every now and then when we have an academic discussion like this. In the meantime, I plan to request some suggestions from him so as to incorporate his genuine ideas. Genuine? Well, I cannot be that presumptive as he is. I may use some of his ideas, although he tries to justify them as being 'U country' -oriented or originated. Let's see what upcoming moments hold for me.

"Do you have this one? This is a very useful book on student evaluation. I suggest you prescribe this as a textbook for the mathematics teacher education program. It includes ways of constructing different forms of standardised tests following universal methods. And, I think Nepali teachers need to know and implement such ideas to improve their teaching. I will give you this and another set of three/four books, today. They cover areas such as psychology, learning and evaluation. You can also borrow books from Dr. Authority and Prof. Prescription. Then, incorporate ideas from appropriate books published in U and prescribed by U-universities. In this way the proposed program will produce quality teachers as well as provides our program with a basis for connecting globally. Remember, we need a globally justifiable teacher education program. And, we need to make globalisation the defining identity of our teacher education program."

Our meeting ends on a positive note so that we keep the channel open for discussion. At least this is good for now. It seems to me that I need to be strategic to get things done here. But the 'real me' hates these things – acting as per the interests of the other, following unjustifiable bureaucratic procedures, leaving my professional judgement at the mercy of the other, and making my own vision invisible in the process. As I get out of Dr. Director's office, a support staff member is ready to share the load of seemingly old books. The support staff and I put them on the table in my office to check their bibliographical information. Unsurprisingly, all these books are published in the early '60s and probably they are out of print: Measurement and Evaluation, Psychological Foundations, Behavioural Foundations, Educational Testing, and so on and so forth.

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Being Here: We Need Globalisation, But The Empowering One!

Dear Dr. Director

In this way, the story, *Being There: We Need A Globally Justifiable Teacher Education* represents one of our many meetings that have taken place in the year 2005. Perhaps, most of the meetings have ended with your suggestion that I need to make sure that our teacher education program is designed according to 'global standards'. Every time you announce globalisation, you refer to following the teacher education system of a particular country. Sadly, my contestations have not been enough! Indeed, having had several meetings with you, I feel as if you are the truer representative of 'that' country than our own. Puzzled by such a narrow view of globalisation, I have decided to write this open letter explaining my critical view of hegemonic globalisation, thereby offering ways to conceive a more justifiable and empowering version of globalisation that may help develop a vision for contextualized mathematics teacher education program which is inclusive of multi-lingual and multi-cultural Nepali realities.

Critiquing Disempowering Globalisation

I relate myself to a person who prefers mosaic, eclectic and multiplistic worldviews. Perhaps such a preference is linked with a realisation that my personal and professional situatedness is in a country which hosts more than 90-language groups[83] and unique and diverse cultural practices. Therefore, the idea of globalisation as hegemony of a foreign worldview does not convince me that such an exclusive view is inclusive of knowledge systems arising from lifeworlds of Nepali people. I believe that if we are to make the mathematics teacher education program fully capable of producing teachers who can teach mathematics by incorporating students' diverse lifeworlds, we need an inclusive view of globalisation that helps incorporate local knowledge traditions in the teacher education program. Arriving at this point, I have

[83] Accessible via www.ethnologue.com (verified on 19/06/09)

to say clearly that your view of globalisation arises from a host of exclusive concepts, ab/using it to impose the worldviews of a particular country or countries on our teacher education program. Here, I am going to unpack two of them: *globalisation as Westernisation* and *universalisation*.

a) Westernisation*:* It seems to me that your notion of globalisation can be compared with the narrow view of *globalisation as Westernisation* which can be described as an approach to unquestioningly importing and legitimating the Western Modern Worldview as the sole orienting framework for our thinking and actions (Scholte, 2008). In my mind the Western Modern Worldview is oriented mainly by conventional logics (propositional, deductive and analytical (see Section Four)) which promote many unhelpful dualisms, such as global versus local, Western versus Eastern, and rational versus non-rational knowledge systems (see Section Two). Furthermore, Westernisation is a process of privileging rational knowledge systems guided by both those conventional logics and bureaucratised representational means so as to over-exaggerate sameness and homogeneity (Peters, 2005). This notion of a rational knowledge system is so hegemonic in our professional contexts that I have encountered rhetoric like this: *knowledge systems embedded in our cultural practices are not rational because they are not guided by rationality.* Do you also favour such a view? In my mind such a far-reaching rhetoric shapes the consciousness of many teachers and teacher educators, thereby contributing to unfavourable situations for knowledge systems that arise from people's practices. Such a dualism of local versus global that is played out in the field of mathematics teacher education is less likely to create empowering pedagogic synergies of knowledge systems arising from different worldviews.

One big machine
Mass production
One shape and size fits

My notion of bureaucratic representation indicates the way in which concepts, ideas and knowledge are expressed in distorted, reductive and unchallenged structural forms of language (R. P. Watson, 1997). You may argue here that a bureaucratised representational system is helpful for organising and communicating ideas because the 'structure' is already there. I find this attitude disempowering for mathematics teachers wishing to construct creative pedagogies. It may be due to the hegemony of the bureaucratic representation of the knowledge system that our (your and my) consciousnesses cannot help realise possibilities of incorporating knowledge systems arising from our own cultural practices. Let me share my experience of conversing about ethnomathematics with a group of professors of mathematics education. It can be any day in 2006, one of my colleagues makes an hour-long presentation to a group of university professors on transformative potentials of ethno-mathematics as a link between modern (pure) and traditional (impure) mathematical practices (D'Ambrosio, 2006). In the presentation, he critiqued the exclusive image of *globalisation as Westernisation* because it has been a warrant for imposing one particular view of the nature of mathematics on the education system of transitional countries like ours. Surprisingly, during informal discussions after the presentation most of the participating professors commented that our local mathematical practices are not structured enough to be regarded as mathematics. In my mind their views of what counts as mathematics has been distortedly shaped by the hegemony of Westernisation that if there is no English/Greek symbols and formal algorithms then there is no mathematics. Do you think that it is justifiable to say that mathematics is all about the Anglo-Greek symbolic-algorithmic system? Cannot mathematics be of an embodied type (regulated via our conscious and subconscious, explicit and implicit, felt and reasoned, and reflexive and reflective systems embedded in our body-mind complex (Nuñez, 2006)) of knowledge system that is regulated via our contextual thinking and actions?

Weed's encroachment
Local flowers begin to die
Dictionary changes

In my mind such a narrow view of globalisation affects our mathematics teacher education program in three possible ways. First, having been oriented by the view of globalisation as Westernisation our mathematics teacher education program may not be able to maintain praxis-oriented engagement in problems and issues arising from our socio-cultural contexts. My notion of praxis-oriented engagement indicates dialectical and reciprocal relationships between the teacher education program and contexts for which to prepare teachers. By dialectical relationship, I am referring to the dependent co-arising nature of sometimes opposing and complementary ideas and concepts (Nagarjuna et al., 1990). Unlike such a dialectical perspective, you seem to imply a dualistic perspective that Western knowledge systems are superior to knowledge systems arising from the cultural practices of our people. Here, my notion of culture entails activities that are performed to generate meanings. However, I do not mean to say that we should replace all Western knowledge systems by knowledge systems arising from our cultural practices, rather my emphasis is on developing a critical outlook on their decontextualised posture and exclusive nature relative to our contexts.

Second, the narrow view of *globalisation as Westernisation* is less likely to acknowledge the importance of knowledge systems arising from collective cultural practices of our people. Your view of globalisation results in an unthinkable subordination of wisdoms arising from our personal-cultural and professional situatedness. Don't you think that our unique cultural-professional experiences as teacher educators are not an entirely helpful referent for designing meaningful pedagogies? I argue that your narrow view of globalisation that appears to have an agenda of the imposition of patterns of Western social relations is less likely to give an epistemic status to local knowledge systems unless they conform to the value of the *Western Modern Worldview* (Rizvi, 2006, my emphasis). In such a situation, knowledge systems arising from our diverse cultural practices are less likely to be a source for the knowledge base of our teacher education program.

Third, I am fearful that by privileging one particular type of knowledge system and practice through the teacher education program it is likely to produce teachers with a narrow view of mathematics education. As the emphasis is on one type of worldview, much needed dynamism, which is possible through meaningful synergies between sometimes opposing, and complementary worldviews, may become a distant phenomenon in our mathematics teacher education. You may agree with me that hegemony of one particular worldview in the name of globalisation is more akin to dissolving contextual cultural variations and moving toward the project of homogenisation (Lingard & Rizvi, 1998). Why do we ever call this globalisation? Perhaps, it is an abuse of a conceptual label that can be

Frogs in the garden
Butterflies' funeral
Normalcy perpetuates

used to represent more inclusive and empowering perspectives than the one which you seem to promote unquestioningly.

b) Universalisation: Perhaps, you are aware that that narrow view of *globalisation as Westernisation* can be strengthened further by yet another narrow view of *globalisation as universalisation* (Bayart, 2008; Robertson, 1992). Such a view of globalisation seems to legitimate one particular worldview as being ‘superior and standard’ whilst discounting other worldviews as being inferior, impractical and primitive. However, I do not dismiss the positive aspect of universalism that arises from several wisdom traditions that promote inter-being and co-existence among dissimilar perspectives, views, ideas, people and ecologies (Hanh, 2000). Ironically, the narrow view of universalisation (equating one worldview with the universe!) appears to discount such an empowering view of co-existence by embracing universalisation as a project toward homogenisation with worldwide socio-cultural convergence via a singular worldview promoted largely by the Western Modern Worldview. Here I agree with Edwards and Usher (2000) who maintain that “privileging of certain position as universal has functioned as a legitimated device, a means of drawing and maintaining boundaries of the valuable and the useful” (p. 71). Perhaps, the notion of valuable is associated with those knowledge systems which help our teachers inculcate their cultural capital, whereas the notion of useful is taken to bolster the legitimacy of the narrow view of globalisation as universalisation with argument that universal knowledge is useful. Thus, your suggestion of importing one particular model of teacher education, and then fitting our teacher education program in that framework may not be helpful for conceiving a contextually valuable model that can transform our mathematics teachers from transmitters of one particular form of mathematics to facilitators of multiple forms of mathematics. Don’t you think that we need to work out a transformative vision that helps teachers incorporate local knowledge systems in their day-to-day pedagogies?

Let me share with you possible disempowering implications of the narrow view of *globalisation as universalisation* for teacher education in Nepal. First, this view of globalisation seems to profess that ways of formulating and running teacher education programs are the same everywhere irrespective of context and place. This one-size-fits-all approach appears to position us at the receiving end of the production, legitimation and distribution of knowledge, thereby un/wittingly being passive recipients of such knowledge in the name of universalisation. In my view, the notion of sameness is exaggerated as if there are no marked differences between our context and the 'Western' or 'First World' context in which such knowledge is seemingly generated, although it does draw on knowledge system, such as the algebra of Islamic writers, Calculus of South Indian Brahmins and numerical methods of Chinese scholars (Almeida & Joseph, 2007; Eves, 1990; Joseph, 2000). For example, one of the books you gave me mentions different types of tests, such as personality test, intelligence test and aptitude test as if there is a singular best method of measuring and predicting our personality, intelligence and aptitude (e.g., Freeman, 1962). These tests may be useful for certain contexts but they are less likely to be exclusively useful for mathematics teachers in developing an holistic and meaningful assessment strategies that account for the culturally situated intelligences of their students (Sternberg, 2007). I am not saying that we should avoid books and knowledge systems that promote the Western Modern Worldview-inspired universalisation, rather I hold the view that we need a critical outlook before any knowledge colonises our minds and hearts in the name of universalism. Furthermore, as I am critiquing your suggestion of prescribing only books published in the First World (Western) country (s), I am also aware of my own practice of using literature originated in the Western (or the First World) context. Here, I have used the term 'Western' as a metaphor of a worldview rather than a bounded territory and fixed human makeup. Indeed, my critique is not so much about the books themselves, but about the possible singular worldview embedded in them and their uncritical use by our teachers and teacher educators.

A big overcoat
Everybody can wear
But fits nobody

Second, this narrow view of globalisation also harbours the unhelpful duality of universalism versus contextualism. Etymologically, the term context arises from the Latin word, *contextus,* meaning weaved or connected together (http://www.ismbook.com/). Thus, the notion of contextualism refers to the view that knowledge and knowing are always context bound, no matter where and how they are produced (Stanley, 2005). I argue from a post-structural perspective (drawing on Brown, 2007; Olssen, 2008) that the notion of contextualism is about promoting inter-textuality between varying cultural products and lifeforms. Thus, creating a duality between universal and contextual does not help develop an inclusive teacher education program nor does the duality offer us a creative and empowering vision for addressing the linguistic[84] and cultural diversities of our multicultural context. It may appear as if I am also promoting yet another dualism-prone view of contextualism. However, my emphasis is not on exclusive hegemony of any standpoint; rather I am trying to unpack the idea of contextualism so as to challenge such a perpetual duality of contextualism versus universalism promoted by the metonymy[85] of *globalisation as universalisation*. My deep-seated desire is to create an inclusive space that allows both universalism and contextualism to operate in synergistic ways. Is it possible to make sense of universalism without contextualism and *vice versa*? Cannot universalism arise out of contextualism, and *vice versa*? Is it justifiable to embrace only the aspect of universalism whilst neglecting the aspect of contextualism as the former cannot be fully realised without the presence of the latter, and *vice versa*?

Comprador Intelligentsia OR Transformative Attitude?

Dr. Director, arriving at this point of my letter writing journey, I request you to think about possible answers to this question of mine: Do you want us to be comprador intelligentsias or agents for transformation? I envisage that a postcolonial perspective is helpful for responding to this question. Post-colonialism contests any forms of colonialism that might be associated with the

A wholesale company
appoints a representative
Comprador rules the local market!

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[84] Nepal hosts 90 different language groups. See: http://www.ethnologue.com/show_country.asp?name=np (verified on 14/02/2009)

[85] Metonym is a metaphor in which part of a concept is taken to represent the whole concept. In the case of globalisation, which is a multifaceted concept (comprising conversation, exchange, discourse, etc.), often only one of its aspects (Westernisation) is taken to represent the whole concept (Lakoff & Johnson, 1980)

narrow view of globalisation. In recent years post- colonial thinkers have articulated the notion of globalisation through a host of reflexive, reciprocal and mutual relationships between local and global, contextual and universal, and many other seemingly opposing attributes (Bhabha, 1994; Loomba, 1998). Similarly, from a post-colonial perspective, the notion of comprador intelligentsia represents an intermediary person who serves the interests of his/her colonial master rather than his/her own people (López, 2001). Indeed, we (you and I) both may have this attitude within us to varying degrees. On the contrary, I envisage that the notion of a transformative attitude entails dispositions of going beyond restrictive legacies, hegemonic worldviews and dualistic logics (O'Sullivan, 2002). In what follows, I shall elaborate key differences between comprador intelligentsia and transformative attitudes.

In my mind a comprador intelligentsia supports and stands for an uncritical importation of ideas from his/her colonial master(s), and acts as the key person to serve the interests of Westernisation in the name of globalisation. In the case of teacher education, such a blind importation may result in uncritical use of the Western Modern Worldview as the orienting framework for mathematics teacher education programs, thereby conceiving a dualistic view of knowledge (as object) and knowing (as subject) (Dunlop, 1999). On the contrary, an agent who works for transformation advocates contextual adaptability and synergistic possibility of any worldviews and knowledge systems, thereby striving to maintain a critical and inclusive outlook, with an intention to promote an agentic view of mathematics teacher education.

Second, a comprador intelligentsia is often locked in the world of reformation. In my view, the world of reformation constitutes a network of perspectives that are less likely to encourage critical reflection, authentic and change-oriented vision and meaningful participations of actual beneficiaries. Furthermore, reformation becomes a process of acting from within a pre-existing distorted framework, thereby undermining its interaction with the outside (i.e., social, cultural and political contexts) (Mezirow, 2005). It is highly likely that a reform process will

An old man speaks
Of his past un-reflexively
High chances of imposition

be locked in the narrow framework of 're-forming schools through curriculum change' without looking to broader possibilities for helping them shift from a singular worldview to multiplistic worldviews. In this situation, the meaning of curriculum is restricted to be a document or subject matter rather than a broad array of epistemic and pedagogic practices. On the contrary, a transformative agent acknowledges that such a reformist view may be necessary but is insufficient for changing mathematics teacher education in a sustainable way. S/he is likely to acknowledge the disempowering posture of any pre-existing distorted framework, thereby making it visible by bringing many other frameworks to exist in the process.

Third, a comprador intelligentsia is an attitude that can flourish well with the help of control and hegemony (Juan Jr, 2007). As a comprador is taken to represent the person who plays the role of intermediary, the notion of intelligentsia gives the connotation of a learned, knowledgeable and trained person. In post-colonial contexts, the qualifier of intelligentsia helps maintain a hegemonic relationship with other local/native people as a result of various forms of social hierarchy. As a result, comprador intelligentsias are able to impose their ideas on teachers and teacher educators who are believed to be less learned or lacking 'advanced degrees' from universities of First World countries. On the contrary, the person who works for a transformative endeavour in teacher education is aware of possible hegemonic and control-propelling situations, thereby acting for empowering changes in the landscape of mathematics teacher education.

Fourth, I envisage that without a disempowering global order (e.g., *globalisation as Westernisation* and *universalisation*) the comprador intelligentsia-attitude will fade out from the field of mathematics teacher education (McLaren, 2005). For a comprador intelligentsia, such a global order provides him/her with a much-needed framework to condemn local practices and knowledge systems for allegedly being primitive. Let me share an experience with you. Once I was talking with a teacher educator about possibilities of including culturally contextualised pedagogies, such as sitting with grandmother, knowing how to plough and learning through perpetual engagement[86]. His response was that these pedagogies are not proven enough to be valid for our formal education system. Unlike such a dismissive posture toward our culturally generated knowledge system, a transformative attitude is likely to act inclusively, thereby creating meaningful synergies between local and global orders. Informed by such views, transformative perspectives can be a Trojan horse to comprador intelligentsia-attitude which does not see any value in knowledge systems arising from our cultural practices (Bowers, 2005).

Fifth, another disempowering feature of comprador intelligentsia attitude is to privilege the 'realist agenda' (McLaren, 2003) in mathematics teacher education. You may think that realist agendas are useful for providing us with a picture of what happens in schools and classrooms so as to generate an inclusive vision of contextualised mathematics education. Indeed, realist agendas are not sufficient for representing various dimensions of reality embedded in the schooling context (Curren, 2005). I argue here that realist agendas seem to reflect an uncritical adoption of the Western Modern Worldview, thereby having a minimal possibility for helping to generate an inclusive and agentic mathematics education. On the contrary, having embraced a transformative attitude, we shall not adhere to superficial realist agendas, rather we shall look for agendas that are unique to our contexts. To do so a transformative agent can use multiple sources and referents to account for different perspectives and interests of actors associated with teacher education. In my mind, a transformative teacher educator is likely to prioritise exploring and generating agendas from contexts whilst using different and sometimes opposing ideas as referents.

Staying away from the edge
Confirming the order
Signs of a good follower

[86] In rural Nepali contexts children learn various skills from their grandparents. As sitting with grandmother entails a pedagogy of care and empathy, it has a possibility of being used as a transformative pedagogy (of care) in mathematics education. Similarly, knowing how to plough can be used as a special form of pedagogy that includes a task with dissimilar subtasks and subskills. Another popular saying: if you engage constantly in the *field*, plants will recognise you, can also be used as a pedagogical referent for learning through engagement in contexts.

Glocalisation: A Transformative Vision for an Inclusive Teacher Education

As I have critiqued your narrow views of globalisation, I am morally bound to present an alternative vision to the hegemonic views of *globalisation as Westernisation* and *universalisation*. You may speculate ironically that I will argue for a contextualisation that is guided exclusively by Easternisation (sic) and localisation. Well, as I argued already, I am not in favour of promoting unhelpful dualisms as they do not provide us with expanded opportunities to think and act in multiple ways; instead, I opt for an inclusive way to conceive our teacher education program via a vision of 'small g glocalisation'. Also I do not claim that my view of glocalisation is a grand-narrative that can explain all about Glocalisation. In my mind, glocalisation is an approach to rescuing inclusive view of globalisation from the longstanding Western orthodoxy that often uses an exclusive lens to insert strategically its worldview in the name of universalisation (Swyngedouw, 2004). Literally speaking, glocalisation represents a continuous interplay and interactivity between globalisation and localisation (sic), thereby offering a perspective that both globalisation and localisation are inseparable aspects of the same phenomenon (Kloos, 2000). Given this conception, I have generated five empowering features of glocalisation. They are: (a) glocalisation can be regarded as an expression of dialectical relationships between local and global practices; (b) it can be used to construct spaces called *glocals* which have the potential to generate empowering synergies between localisation and globalisation (Doherty, 2008; Gunnlaugson, 2004); (c) it is likely to help us contest any form of hegemony prevalent in mathematics teacher education; (d) glocalisation possibly offers an inclusive and agentic vision for teachers and teacher educators to think and act creatively; and (e) it can help preserve and promote a positive image of *globalisation as conversation* (Henry, 1999). Let me elaborate on how these features are helpful for conceiving a contextualised mathematics teacher education program.

Ants collect and store the food A lazy caterpillar makes them learn new

Water and soil Creation of mud A sculptor muses

Dear Dr. Director, I argue that glocalisation is an expression of a dialectical relationship between globalisation and localisation. From this perspective, globalisation arises from localisation and *vice versa*. With the help of dialectical logic, hegemonic images of *globalisation as Westernisation and universalisation* can be taken as just one aspect of the entirety of a planetary process, thereby making them related to their complementary conceptual labels, such as Easternisation (sic), localisation, tribalisation (sic) and contextualisation. In this process, we can identify limitations inherent in such conceptual labels, thereby conceiving ways to articulate mathematics teacher education in more inclusive and synergistic ways. You may say here that: I am enforcing yet another form of dualism: globalisation versus localisation. Indeed, my intention is to contest the narrow view of globalisation. To do so, I am trying to demonstrate that globalisation is not necessarily an exclusive construct rather it co-exists with its sometimes contrary construct, localisation.

I argue here that dialectical logic embedded in glocalisation can help us create synergistic spaces of interdependent, reflexive and co-arising relationships between global and local processes (Kloos, 2000). Such spaces (glocals) are likely to offer ways to generate synergistic and agentic pedagogical visions for mathematics teacher education. Here, agentic pedagogical visions entail ways in which the individual learner is encouraged to construct their understanding of mathematics, thereby connecting and communicating it with others. You may agree with me that glocals can be those spaces which help us realise fully the competing and complementary nature of knowledge systems arising from our own cultural context and from the Western Modern Worldview. Precisely speaking, such spaces help us realise how objectivity and subjectivity, global and local, transcendental and cultural, universal and contextual, and Western and non-Western exist side-by-side (Robertson, 1995), thereby challenging the uncritical importation of the education system of any particular country. Therefore, in designing a teacher education program, the synergistic hybrid of glocalisation can offer us a basis for (i) incorporating knowledge systems arising from local cultural practices; (b) linking with knowledge systems arising from multiple worldviews; and (c) conceiving meaningful pedagogies of mathematics for diverse cultural contexts.

The sun in the winter
looks like the moon
Has it lost its essence?

In this way, glocalisation can be best described by the two-way border crossing metaphor that helps us challenge the hegemonic extremes of anything including both globalisation and localisation. Indeed, the exclusive view of globalisation does not help us and our teachers realise the disempowering limitations of a hegemonic worldview. On the other hand, an extreme advocacy of localisation does not empower our teachers to apply multiple referents to their pedagogical creativity. Therefore, glocalisation provide us with opportunities to challenge both forms of hegemony, thereby opening for multiple opportunities through the interplay of ideas and actions in context. It can be through the space created by glocalisation that we help teachers examine the limitations and advantages of knowledge systems arising from different worldviews, thereby developing a contextualised vision of their pedagogy (Globalism Institute, 2003; Kleyn, 2006). Indeed, my notion of contextualisation is not an exclusionary view; rather it is an attempt to harness positive aspect of globalisation in a sustainable way. In my mind a well conceived contextualised teacher education does not promote any form of hegemony apart from the emphasis on dialectical relationships between sometimes opposing, contradictory and complementary perspectives.

Therefore, I believe that glocalisation can offer inclusive and agentic visions for teachers and teacher educators so as to incorporate knowledge systems and wisdoms arising from local cultural practices. Here I use the term 'agentic' to refer to the view that every learner is an agent of herself/himself. In my mind, learning cannot simply be an act of receiving information but is an active process of restructuring self-perspective, co-working with others (Gergen, 1995). Thus, inclusive visions are helpful for conceiving pedagogies that account for varying potentials of learners, whereas exclusive worldviews privilege a particular aspect of mathematics education. In my mind, inclusive visions generated through spaces of glocalisation can facilitate mathematics teachers and teacher educators to prepare their students to be active citizenry, a label that is used to represent the image of *students as future change makers*. In this process, mathematics teachers are able to develop in their students' understanding that (i) mathematical knowledge arises from different sources, one of which is the day-to-day cultural practices of people; (ii) harnessing the power of mathematics requires creative and contextual thinking; and (iii) mathematics can be used for changing the world around them.

Section Six

Finally, glocalisation is an expression that can promote a positive image of globalisation as dialogic relationships between different cultures and worldviews (Yang, 2003). It can be this perspective which promotes the view that Nepali knowledge systems are included in the 'global repository', thereby creating possibilities for generating spaces for promoting dialogue between diverse knowledge systems (Robertson, 1992). In my mind, such a view of globalisation imbued in the notion of glocalisation can be useful for promoting a pedagogy of two-way border crossing between their and others' worldviews (Aikenhead, 2006; Giroux, 1992). By employing such a border pedagogy, Nepali mathematics teachers are likely to: (i) encourage students to search for different forms of mathematics and their present and future uses; (ii) help students explore local classifications/ categories of mathematical knowledge and their interactivity with official mathematical categories; and (iii) develop emergent pedagogies that promote interactivity between different mathematical knowledge systems.

Dr. Director, I hope that you have now started thinking about incorporating some of the ideas that I have suggested in this letter. Perhaps, my discussions of two narrow views of globalisation have helped us think creatively about embracing an empowering image of globalisation as conversation. I hold the view that changing ourselves from comprador intelligentsias to transformative agents makes it possible to incorporate synergistic visions in our teacher education program, thereby liberating our mathematics teacher education from disempowering single-minded perspectives. In my experience, another disempowering perspective arises from a narrow foundationalist view held by some mathematics teacher educators. Thus, the upcoming journey explores this disempowering feature through yet another open letter to Dr. Authority. Hoping to hear your comments in the near future, I would like my fingers to take a brief rest so as to start yet another journey of inquiring into the prevailing foundationalism in mathematics teacher education of Nepal.

Sincerely yours

Bal Chandra

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CHAPTER 15: DECONSTRUCTING FOUNDATIONALISM: PROPOSING A HEALTHY SCEPTICISM FOR INCLUSIVE MATHEMATICS TEACHER EDUCATION

Being There: Follow The Foundation Of Mathematics Education!

It can be any day in the month of April 2005. I am about to make a phone call to Dr. Authority about possibilities of sending my proposal to his place and receiving his review comments on it. Spending nearly 10 to 15 minutes, I finally find Dr. Authority's number and dial the number: 4xxxxxx.

"Hello"

"May I speak to Dr. Authority?"

"May I know your name?"

"I am Bal Chandra, from the U of Himalaya"

"Hang on a minute. Dr. Authority is coming."

"Who am I talking with?"

"Namaste Dr. Authority! This is Bal Chandra from the University of Himalaya. We are developing a two-year mathematics teacher education program. And, I am seeking your help in this regard."

"Well, I cannot commit myself as a tutor as your department outsources many part-time academic staff members. I am too old to do that. What specifically do you want from me?"

"At this stage could you please read my proposal for the program and provide us with your critical suggestions within a week?"

"Well. How thick is the document? If it is like a 15/20-page, I can provide you with comments and suggestions within a week."

"Yes Dr. Authority, it's a 13-page slim document, and I will send someone to your place today."

"Ok. That is a good idea."

"Thank you. Namaste."

"..."

I read the proposal two/three times to check if there are any typos and grammatical errors. It has taken my precious three mornings to make sure that the document is in order. I give one hard copy to our mailperson to send to Dr. Authority's residence. I call Dr. Authority that evening to make sure that the document reached his place.

A week has passed by since Dr. Authority has received the document. I call him again to make sure that I am receiving his feedback in the stipulated time.

"4xxxxxx"

"Hello. Who is speaking?"

"Namaste Sir! This is Bal Chandra again. Have you finished reading my proposal?"

"Thankfully, I finished yesterday evening. I could not read during the daytime of this and last week as I was attending various cultural programs organised by family and friends. The life of a retiree! Another problem is that I cannot read for more than half an hour in one sitting. By the way, are you ready to hear my comments?"

"Well, yes. But let me call you from another room. The noise here is appalling."

"Before to sharing my comments, let me ask you one straight question: Which system are you following here, U-system or A-system? I heard that you have completed advanced studies from a university of A."

I am saddened by meaningless questions again. What should I do next, just hang up the phone and forget about the launching of the new program. But I feel a presence of a consoling self that says: Don't walk away. There is more to it.

"Yes I have completed postgraduate studies from a university of A. But Sir, this is not a program based on either the U or A-system, this is an attempt to develop a good teacher education program that can help improve Nepali mathematics education."

"I am asking this question because you missed some important concepts in the proposed course of mathematics education. A friend of mine told me some years back that mathematics teacher education departments of universities of other than the U

country are not serious about following the foundation of mathematics education. I have also heard recently that some universities of U have left this recently and started questioning the foundation. But, they are in a minority. Your program does not follow the foundational framework. You have included much non-Mathematics Education stuff in the course outline. I suggest you pay special attention to the logical and psychological aspects of the foundation. For me, the sociological aspect is not that important because it brings unnecessary stuff to mathematics education. Let me make clear that the logical aspect of the foundation is helpful for preserving the analytical rigor, deductive power and purity of mathematical algorithms whereas the psychological component helps teachers understand and make use of valid, objective and proven theories of learning. And, such theories of learning are the ultimate source of pedagogy for our mathematics teachers."

Is he bringing his nearly three-decade old experience of doing his doctoral studies in a U-based university? I know he is talking about the foundation that I came to know during my M Ed studies. It is hopeless. It promotes transmissionist pedagogy. Well, I am not interested in having arguments on meaningless issues. But can I avoid this in the present situation? Can I escape ever from such naive questions and comments?

"Sir, could you please suggest me the sources that I can read to incorporate the foundational aspect in the course?"

"Well, I have a book published some years back. If you want to have a look, I can send with your mailperson when he comes to collect my written comments on your proposal. Please take it seriously that the foundation of mathematics education has become our identity, it is indubitable concept, we have internalised it, and it is a perspective that helps orient our teachers to the importance of the logical structure of mathematics and appropriate pedagogy for it."

I tighten my mouth for a while. It is amazing that silence can be a sustainable means of resistance. I read in a book that one of Buddha's popular methods was silence that helped him avoid unnecessary debates and un-empathetic exchanges.

"Thank you for your comments. I will look into them when I receive a written copy of your comments. By the way, do you want to share any other urgent comments? I have a meeting with students?"

"I have already expressed my urgent comment. The second one is the way you have written the course learning objectives which cannot be measurable and are vague. For example, how can you measure understanding? Again, we have internalised 'behavioural objectives' as fundamental aspect of teacher education. Please be mindful of this. As far as other comments are concerned, I will send a written copy of them. But pay attention to following the foundation of mathematics education as a basis for designing your teacher education program. And, it has been our identity as most of the teacher education departments use foundationalism as the orienting framework of mathematics education."

"Thank you for your precious time, Sir. It is my pleasure talking to you over the phone. By the way I will send our mailperson today or tomorrow to collect your written comments. Thanks once again. Bye."

I play a diplomatic language game. Indeed my 'thankyou' to Dr. Authority is not for his comments but for his agreement in ending the conversation. But one question keeps on popping into my mind: How to transform the identity of our teacher education program from foundationalism to non/foundationalism?

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Being Here: Let Us Question The Indubitable Foundation!

Dear Dr. Authority

I am writing this letter to share my perceptions about your view of the foundation of mathematics education. I hope that this open letter can be a helpful means for elaborating on my critical views about your notion of the foundation of mathematics education, thereby offering an inclusive vision for incorporating both of our views insofar as they help develop visions for contextualised mathematics teacher education. For several reasons, I have not been able to ask you about your reasoned and felt (because you could speak from the bottom of your heart as an experienced teacher educator) meanings and definition of foundation in your comments on my proposal. However, our conversation depicted in the story indicates that you seem to regard the foundation of mathematics education as an indubitable and unchangeable framework only through which we can develop a mathematics teacher education program. Furthermore, my recent reviews of literature suggest that foundationalism is a tendency to hold the view that: (i) all knowledge arises from non-inferential knowledge or justified belief (Fumerton, 2005); (ii) "knowledge must have a foundation and that the rest of what is known must rest on (that is, derive its justificatory status from) that foundation" (Aikin, 2007, p. 579); (iii) "epistemically basic beliefs must be certain, incorrigible, or infallible" (Hopp, 2008, p. 196); and (iv) the only way that we can sufficiently justify our beliefs or knowledge is to show how they depend on or rest on or arise from some basic beliefs (or 'foundations') that they do not need justification and are beyond scepticism (Carr, 2006). Are you thinking along these lines? Or do you have a different definition?

Informed by different views about foundationalism, I am charting the journey of letter writing through three themes that appear to be associated with your notion of foundation. First, I elaborate on the infallible and incorrigible view of the foundation of mathematics education embedded in your advocacy of the foundationalism as the orienting framework for developing our teacher education programs. In doing so I present myself as a critic of anti-scepticism embedded in the project of foundationalism. The second part of this letter challenges the decontextualisation of knowledge and knowing embedded in your narrow foundationalism, thereby offering some inclusive perspectives to pacify the exclusive nature of foundationalism in our mathematics teacher education program. Finally, I will critique mimetic and transmissionist pedagogies that arise from your exclusive view of foundationalism, thereby offering alternative visions of inclusive pedagogies for contextualised mathematics teacher education program.

Welcome Healthy Scepticism

Dear Dr. Authority, let me start this part of the letter by sharing an experience in 2004 when I worked with a teacher educator who has recently graduated from a teacher education program of a university of Nepal. I invited him to collaborate with me to facilitate a three-day teacher education workshop on teaching geometry for high school teachers. I requested him to share his workshop plan with me and I prepared myself with the same. His plan of facilitating teaching proof in geometry could not offer any new insights into creative pedagogical aspects rather it entailed a plan for teaching teachers about the basic concepts associated with proofs of some theorems. I shared with him my plan of including a narrative of my experience of learning geometry (e.g., Drake & Sherin, 2006), and of involving teachers in a two-stage play about different types of geometry. In all my workshop activities my plan was to help teachers maintain some degree of scepticism in their thinking and actions. But my collaborator came next day to express his inability in using such activities because he believed that it was an irreparable sin to be critical about mathematics whilst being a mathematics teacher educator. After several attempts, I convinced him to use some props that could help teachers think about boundary conditions of geometric proofs being employed in our school curriculum.

Aftermath of a big quake
Person 1 asks,
Was the foundation not strong enough?
Person 2 says,
Foundation was too strong and rigid
Person 3 opines,
A flexible foundation could minimize the damage

Dr. Authority, I am not generalising that this case represents an attribute of all mathematics teacher educators who have been oriented according to your narrow foundationalism. But this encounter suggests that the non-sceptical posture embedded in the foundation of mathematics education does not help mathematics teachers and teacher educators go beyond the narrow structural boundary of mathematical knowledge (Hersh, 1997). Here, the notion of narrow structural boundary means the unhelpful myth that mathematics is always structured in a singular, objective and incorrigible way. How can you expect innovation if you educate teachers to be mute followers? Thus, I argue that healthy scepticism helps mathematics teachers renew their pedagogical praxis and knowledge about mathematics.

You may raise a question here: Which version of scepticism do I want to promote in mathematics teacher education program? In my mind scepticism (or doubt) and belief presuppose each other, for there is no scepticism or doubt where there is no belief. Perhaps a healthy scepticism is an expression generated through dialectical relationships between believing and being sceptical at the same time (Bell, 2005). I argue here that both doubting and believing exist alongside our endeavour to understand and accept anything including your foundationalism. Thus with the help of dialectical thinking, I prefer to promote a 'middle way'[87] that does not reject foundationalism totally nor does it prevent prospective teachers from questioning the so-called indubitable foundation of mathematics education. How can your logical and psychological foundations fit within my vision? As far as the logical aspect (e.g. Kuroda, 1958) of the foundation is concerned, prospective teachers and teacher educators will be able to realise limitations of conventional logics (e.g., propositional, deductive and analytical) and linear hierarchical structure (of mathematics)[88] embedded in mathematics education. And, there are possibilities that your conventional logical structure of mathematics is modified and adapted together with emergent structures arising from knowledge systems embedded in local cultural practices. In my mind such knowledge systems are largely orientated by logics different from the conventional one, such as dialectical, metaphorical and poetic (see Section Four). Nevertheless, I do not prefer to replace your foundationalism with scepticism, instead I prefer scepticism and foundationalism to co-exist insofar as they promote inclusive and agentic mathematics teacher education programs.

A frog slips in the pond
No route visible to outside
Locked in forever

Dr. Authority, it seems to me that another key element of your foundation is behaviourism which promotes a mechanical view of learning as a linear combination of stimulus and response. An immediate implication of this school of thought in mathematics education is that learning is possible only through repetition, practice and drill (Hilgard & Bower, 1977). Do you really believe that the phenomenon of learning can be explained only this way? Here, I am hinting at yet another possible 'foundation' that promotes largely cognitive approaches which regard learning as an exclusively mind-centric activity (Shuell, 1986). Do you think that I align myself

[87] In Eastern Wisdom Traditions, Middle Way has served as a perspective to articulate ontological and epistemological spaces that allow us to conceive the relative nature of sometime opposing ideas (Nagarjuna et al., 1990).

[88] Smitherman (2005) calls these logics as narrow analytics which are subservient to reductionist Newtonian science that promote dualism and narratives of stability.

exclusively with cognitivism? Indeed, I hold the view that these theoretical labels do not help much in conceiving the contingent, contextual and emergent nature of the phenomenon of learning. Therefore, a healthy scepticism helps raise questions about the adequacy of your and others' foundations in capturing the experiential landscape of learning.

Similarly, I hold the view that an extreme form of scepticism is not helpful either, for it becomes another foundation of one's thinking which does not make sense of anything but scepticism. My notion of healthy scepticism entails three major steps: engagement, critical reflection and renewal, as bases for acting wisely in our pedagogical contexts. In the first step, our teachers' authentic engagements are pivotal for generating personal practical knowledge about their pedagogic contexts.

Being encouraged to view their pedagogical engagement from critical and reflective eyes, teachers will be able to identify gaps between their beliefs and actions, between theories and practices, and between justified and emergent knowledge (Kenyon & Randall, 1997). For me, such gaps offer an authentic source for renewal of my personal-pedagogical thinking and actions (Granger, 2006). If I buy into your extreme foundationalist view that there is only one way of conceiving mathematics education, I will delimit myself as a passive recipient of knowledge imposed by your foundation. Do you think that this is a meaningful and justifiable way to improve our mathematics teacher education?

Why don't you and I work together to incorporate healthy scepticism into our teacher education program? I envisage that by embracing healthy scepticism we will be able to humanise your extreme foundationalism that often places certain beliefs and knowledge systems outside of the human domain of practice in the name of the non-derivability principle (Polkinghorne, 1992). In my mind, bringing those knowledge systems and beliefs to the domain of critical reflectivity can help transform our teacher education program as a forward-looking endeavour. In my mind such an effort of humanising your foundational view entails (a) introducing a multi-perspectival view (historically, epistemologically and logically) of mathematics education (e.g. Almeida & Joseph, 2007; Ernest, 2004; Vithal, 2004), (b) questioning disempowering features of the foundation, and (c) envisioning multiple foundations for incorporating knowledge systems and pedagogies arising from people's practices in the teacher education program.

Deconstructing Decontextualisation

Dr. Authority, your idea of embracing an extreme form of foundationalism is likely to promote a decontextualised mathematics education which prevents local cultural knowledge systems from being incorporated in our teacher education program. According to my recent exploration (Aikin, 2007; Fumerton, 2005; Hopp, 2008), foundationalism rests upon a realist ontology and objectivist epistemology which regard to valid knowledge systems being independent of political, cultural, social and spiritual influences. Indeed, it is really hard for me to believe in the perspective that knowledge is (or can be) free from those influences because imagining knowledge that is free from human influences is to imagine the world without soulful humans or populated by machine-like humans. Do you really want machine-like teachers or teachers with souls, feelings and sense of being in time and context?

You may ask me this question: *Why are you critiquing realist ontology as it is helpful for capturing a 'much-needed picture' of our schooling?* I encountered a similar question sometime in May 2006 whilst sharing my criticisms of the prevailing realism in teacher education. At that time my response was: *realism is a way to privilege one particular view about reality. In actuality, realist ontology does not help unpack multiple realities of our schooling, such as diverse linguistic, cultural, regional and ethnic realities.* This view of mine has not been changed apart from recognising realism as one of many ways of expressing the multifaceted nature of reality as an orienting feature of our teacher education. Indeed, a realist ontology may not help conceive the notion of reality from contextual, subjective and intersubjective vantage points, rather it tends to privilege the view that reality exists outside of cultural landscapes (Tonkin, 1990).

Frogs in the garden
Butterflies' funeral
Normalcy perpetuates

Next, an objectivist epistemology (Ernest, 1994a, 2006) embedded in your foundationalist view is akin to promoting a decontextualised mathematics education, thereby continuing the privilege of the nature of *mathematics as a body of pure* *mathematics* within the consciousness of mathematics teacher educators (see Section One). Perhaps such a one-sided misrepresentation claims to be the objective view of the nature of mathematics, thereby discouraging multiple images of the nature of mathematics that can be helpful for generating a much-needed vision of an inclusive mathematics teacher education. I argue here that an objectivist epistemology that you seem to profess represents someone's point of view. Why do we not promote multiple ways of knowing rather than the singular, objective way of knowing? Some time in 2005 I was persuading a mathematics teacher trainer to incorporate multiple ways of knowing in a training package for secondary teachers that he was formulating. After hearing my argument, he questioned whether I was requesting him to replace objective teaching methods of mathematics. By objective methods, he was probably referring to those teaching methods that he studied in his teacher education course. I forgot now how I responded to his question but at this stage I hold this view: Let's introduce multiple ways of knowing in our teacher education program so that our teachers and teacher educators are facilitated to connect dialectically self with other, local with global, subject with object, and knowledge with wisdom (Basseches, 2005; Jay, 1996; Malabou, 2005). In this way, my idea of contextualisation is not to stay away from objectivism but to use it with other ways of knowing that help cultivate a contextualised pedagogy of mathematics.

In my mind an extreme form of foundationalism promotes the 'a priori view' of mathematics education as a discipline, meaning that mathematics education is built upon some unchangeable givens rather than on the emergent experiences of practitioners, contextual knowledge systems, and a dialectics of theory and practice (Ernest, 2006). My notion of contextual knowledge systems entails knowledge that

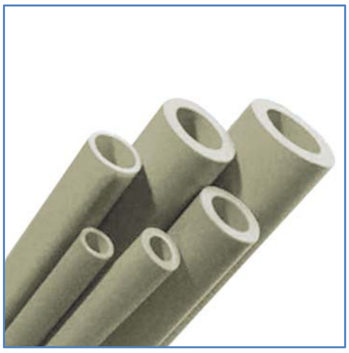
arises from people's lifeworlds. Is your foundationalism inclusive of these practices? I doubt it because your foundation is less likely to be compatible with knowledge systems arising from people's practices, rather it seems to privilege a form of mathematics that is exclusively algorithmic, abstract and disembodied, as you indicate that the logical aspect of the foundation of mathematics education is required to preserve the analytical rigor of mathematics. If you want to incorporate logic as an aspect of your foundation, why don't we include different forms of logic instead of privileging those logics that promote a decontextualised nature of mathematics? I envisage that a contextualised teacher education incorporates both types of logics that are conventional and alternative-inclusive logics. I argue that whilst conventional logics help generate 'objective' mathematical expressions, alternative-inclusive logics help understand them through 'earthly language' inspired by poetic, narrative, metaphoric and dialectical logics (Jardine, 1994).

In my final call, I request that you reconsider your emphasis on the blind importation of 'capital F Foundation' from other country(s). Cannot we develop our own 'small f foundations' (not just one but many) that can address the problem of decontextualised mathematics education, due to which the majority of students are unable to harness the use of mathematics in their present and future lives? From my perspective, your approach is promoting a double layered decontextualisation by (i) importing a foundation that does not interact with our local realities, and then (ii) privileging one 'type' of foundation that does not help account for pluralities pre-existing in our socio-cultural milieux. You may raise a question here: am I advocating that we stop for using others' models, theories and concepts? I do not buy into such an extremism; rather I prefer to promote critical-interactivity with any theories, concepts and models that we are going to incorporate into education. In a nutshell, if your foundation acts as a 'small f foundation' I have no problem. But if you want it to be 'capital F Foundation', it will not be helpful for conceiving an inclusive teacher education program.

Altering Mimetic and Transmissionist Pedagogies

Dr. Authority, a significant question comes to my mind as I arrive at this point: What type of pedagogy does your foundationalism promote? I came to know about a similar foundation of mathematics education that you have suggested incorporating in our mathematics teacher education program whilst undertaking my first master's studies in 1996/1997. My experiences suggest that perspectives associated with such foundationalism seem to promote a transmissionist pedagogy. You may argue here that transmissionism is an essential pedagogy for teachers to transmit mathematical knowledge in a rigorous way. On the basis of our conversation, I envisage that your true sense of the foundation of mathematics education seems to privilege an algorithmic, abstract and symbolic form of mathematics together with the 'cover' of the psychology of behaviourism. What type of pedagogy is promoted by the psychology of behaviourism? In my mind, behaviourism mythicised one (peripheral/outward/mechanical) aspect of learning as the total explanation, thereby neglecting creative and imaginative dimensions of teaching and learning of mathematics. Therefore, guided by inclusive metaphors of *teaching as facilitating* and *learning as constructing* (Sfard, 1998), I am going to explore key features of mimetic and transmissionist pedagogies arising from exclusive foundationalism.

It is not my absolute claim that your foundationalism is solely responsible for instilling transmissionist and mimetic pedagogies in the landscapes of mathematics education. However, I envisage that an exclusive foundationalist view is not helpful to break the vicious circle of mimetic pedagogy. Does behaviourism (your psychological aspect of the foundation) not promote drill and blind practice? Does it not treat students as animals ready to be fed as most of the behaviouristic experiments have been done with animals (Harzem, 2004)? Let me share one instance that has some bearing on these questions. It can be sometime in September, 1999 when I was involved in a teacher training program. I had written a training manual on teaching equations by using fictive stories (Raymond & Leinenbach, 2000). My plan was to help teachers promote student-centred learning. After two/three orientation sessions on using those stories in the classroom, some of the trainee teachers used this approach in their teaching and it turned out to be effective. In the meantime, I invited a mathematics teacher trainer, who was working in the Ministry of Education of Nepal, to share this experience. After the class observation, the teacher trainer commented that the teacher did not teach essential 'basic facts' about equations apart from entertaining students with some humdrum activities. Might the teacher educator not be using foundational view in making such comments? His comments seem to be a result of



your foundationalism-oriented mathematics teacher education program that largely promotes mimetic (e.g., rote-learning, drill, and blind practice) pedagogical practices.

Thus, I argue here that mimetic pedagogy embedded in narrow foundationalism does not help conceive and understand mathematics in multiple ways as it seems to restrict teachers and students within the world of basic facts, formulae and theorem proof together with reified pedagogies of behaviourism which promote only one type of knowing, that is, conceptual knowing (Egan, 1997). Why does your foundational view promote only this type of knowing? Perhaps, it is because of the hegemony of the behaviouristic paradigm that you can measure the extent to which conceptual definitions are recalled, theorem proofs are reproduced, formulae are remembered and algorithms are unquestioningly replicated. Does such a pedagogic creed of rote-motorisation help harness the usefulness of mathematics in the present and future lives of Nepali students? Is this pedagogy sufficiently helpful for bringing meaningfulness to mathematics education? Perhaps, such a mimetic and transmissionist pedagogy can be a key factor in the rampant underachievement in school mathematics as reported by recent national studies (EDSC, 1997, 2003; Koirala & Acharya, 2005; Mathema & Bista, 2006).

Dear Dr. Authority, I would like to invite you to consider this proposal. Why don't you expand your singular 'capital F Foundationalism' to a perspective that includes many 'small f foundations'? Rather than living for a single foundation or theory or philosophy, let us try to live for meaningful pedagogic transformation. In my mind promoting multiple ways of knowing (and learning and teaching) helps rescue mathematics education from such a narrow pedagogy of transmission. Here, my notion of 'multiple ways of understanding' is about accounting for conceptual, reflective, critical and imaginative understatings imbued in the view of multiple intelligences (Eisner, 2004; Gardner, 2006). The notion of reflective understanding is about accounting for autobiographic moments in the impulses of learning. This type of understanding helps students connect mathematics with their personal experiences. Similarly critical understanding can facilitate our students to conceive that reality is also about power that often creates disempowering relations between different groups of people. For instance, whilst student use mathematics to solve problems arising from the world around them, they are likely to unpack such relations surrounding the context in which the problem is related. On other occasions, students can be provided with opportunities to reflect critically upon their learning process. In my mind imaginative understanding empowers students to cultivate various forms of futuristic visions by using mathematics they encounter in their everyday lives.

Dr. Authority, arriving at the final point, I would like to request again that you help me humanise the foundationalist view of mathematics education by employing dialectical logic to incorporate positive aspects of foundationalism and scepticism in mathematics teacher education. I believe that by creating synergies between the positive aspects of foundationalism and scepticism, we will be able to conceive inclusive pedagogies with an image of teachers as awakened facilitators[89], and students as creative thinkers and active citizens. In this way my open letter to you comes to a closure with yet another realisation that I need to further my journey to explore ways in which to address the rampant hegemony of analytical language embedded in the view of many Prof Prescriptions.

Sincerely yours

Bal Chandra

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[89] Drawing from Sri Aurobindo and McDermott (2005), I envisage that embracing an image of *teacher as an awakened facilitator* helps mathematics teachers to think of alternatives to imposing mathematical definitions, theorems and formula *as though* they are the infallible apparatus of ever-developing mathematical knowledge systems. Perhaps, mathematics teachers need to develop themselves as awakened beings, thereby living by the ideals by which their students can be enlightened.

CHAPTER 16: NO TO EXCLUSIONARY VIEWS: IMAGINING INCLUSIVE MATHEMATICS TEACHER EDUCATION

Being There: We Should Hold Dearly Pure Mathematics And Analytical Thinking!

"0xxxxxxxx"

"Hello, N-ji can I talk to Prof. Prescription"

"Namaste Sir, could you please wait for a minute?"

"Hello Bal Chandra, what can I do for you?"

"Have you gone through the document that I sent a week ago as an email attachment?"

"Which document? No, not yet. The email system is not working, here?"

"It's a proposal for launching a mathematics teacher education program at University of Himalaya. I am requesting your comments on the proposal. Shall I send a hard copy, Sir?"

"That will be fine. Please send it with someone."

"You will receive the document tomorrow, Professor. Can I pop in to your office next week so that I can collect your comments on the proposal?"

"Let's do it Monday so that I will have a full week to read your proposal."

In this way, I set a meeting date with Prof. Prescription. In the meantime, I prepare myself to be an absorber of more negative comments on the proposal. I am used to it nowadays as I have conversed with about six professors who have demonstrated their best quality in producing harsh, dismissive, negative and un-empathetic comments on others' work. But I should be aware that I may turn out to be like them by the time our department gets the approval for launching the program?

It is the first Monday of the month of June 2005. I am waiting for Prof Prescription to arrive in his office. His personal secretary says to me that she hasn't seen him around. But she reminded him of today's meeting yesterday when he was leaving the office. In the meantime, my eyes are caught by the whiteboard notes: Meeting with Bal Chandra @12:30. Now I am sure that Prof. Prescription will be here in 10/15 minutes.

"Namaste Sir, How are you?"

"Namaste, I have been caught up by so many administrative issues here. Apart from this, I am fine, thank you."

"Did you get any chance to go through my proposal?"

"Yes. I went through it this morning. There are some serious flaws that you need to correct to make this program a success. Otherwise, your program will end up producing teachers without essential bases for mathematical thinking that require an emphasis on harnessing the skills and knowledge about applying analytical language in solving algorithmic problems and proving important mathematical theorems. "

In the meantime, the secretary leaves the office for lunch. The Professor is busy turning pages of my proposal. I am doubtful that he read it really. But he is Prof. Prescription and I am Bal Chandra. Silence and diplomatic criticality are my best strategies right now.

"Ok sir, how can I improve this aspect, then? Please suggest ways of improving the program. And, I do not want to launch a bad program either."

My seeming acceptance of his salvo puts Prof. Prescription in a difficult situation as he has to offer a vision, an alternative and a possibility rather than a self-indulging critique of what is (and is not) there. He looks out the window and he pushes up his lens with his index finger. Now I sense that he has been contained at least for some minutes.

"Well, have you looked at the programs offered by other universities? Incorporate more pure mathematics types of courses in the program. Include one or two applied mathematics course in the program. But remember, applied mathematics should not overtake pure mathematics as many applied mathematics do not really use analytical

language. Our mathematics teachers need an adequate exposure to pure mathematical content. And applied mathematics can be supplemental to it. Perhaps you may know well that the mother of mathematics is pure mathematics that promotes analytical approaches in expressing knowledge claims in mathematics."

Why is my inner self so silent, now? Perhaps, I am not enthusiastic to challenge Prof Prescription's one-sided view about the nature of mathematics. This is also a situation in which risk-taking is less likely to offer you a payoff.

"Well, my efforts are not sufficient. Perhaps, I need to spend some days looking at other universities' web pages. By the way, did you go through the units that focus on pedagogy? Any comments and suggestions are welcome."

If I have to be honest about my feelings, I want to leave this room soon. I have the gut-feeling that Prof. Prescription has not read the document closely. And, he appears to be very presumptuous that teacher education programs do not teach good (probably 'pure') mathematics. If he has read it closely he could see three units on applied mathematics and four units on pure mathematics. How can I exchange my honest views with those who speak from their pre-existing presumptive cocoons?

"Bal Chandra, please note that the incomparable beauty of mathematics is analytical language. Your program seems to be lacking in this aspect. You know many school curricula around the world are trying to minimize mathematical proof and algorithmic problem solving. But this is the unique identity of the Modernist outlook that we have preserved through our school mathematics education. We need to 'protect' this! How can one conceive mathematics without analytical proof and algorithmic problem solving? Can you replace the analytical language of mathematics by poems and stories? And, you better try to get rid of nonsensical irrational ideas from your program, such as reflective practice, critical mathematics education, ethnomathematics and sociology and anthropology of mathematics education. They prevent teachers from harnessing pure mathematical visions imbued in analytical language that is indispensable for developing a Modernist outlook."

Analytical language is our thing – this worries me again. History tells us that mathematicians of the Indian subcontinent have used various forms of language to communicate their knowledge claims (Joseph, 2000). Rather than using a *decontextualised language of analysis, some have used poetry to communicate their mathematical methods and techniques. Even proofs can be found and inferred in Vedic and Upanishadic verses in poetic ways. Well, they might have used analytical language but this was not the only language at their disposal. Next, if I think about the mathematics of our everyday life, analytical language (and reasoning) is not that important while performing informal problem solving in everyday contexts.*

"Thank you very much for your suggestions, Sir. I will try incorporating some or all of them. I will be back, if I need to discuss with you. See you later."

I wish I could avoid such a one-sided view of mathematics.

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Being Here: Let's Envision A Contextualised Mathematics Teacher Education

Dear Prof Prescription

I would like to start this letter with the concept of the butterfly effect, used by Edward Lorenz (in Fleener, 2005; Smitherman, 2005) to communicate the notion that small variations in initial conditions can result in grossly divergent weather patterns and conditions. Over time, Lorenz's butterfly effect has become a metaphor for 'new age' mathematics that has pointed out clearly that the Euclidean-Newtonian mathematical model of flat surface equilibrium is not sufficient to account for the complex nature of problems such as weather prediction. In recent years, chaos theory[90] and complexity[91] science have become new referents for thinking about indeterminacy, non-linearity, entropy and emergence. I have raised the issue of complexity science and chaos theory to remind you and me that, within the discipline

[90] Chaos theory is a recent development in mathematics that promotes the principles of non-linearity, self-similarity, dynamic system and non-determinism that were originally developed in the fields of physics and mathematics dealing with the structures of turbulence and the self-similar forms of fractal geometry (Ketterer, 2006). Chaos theory addresses the issue that "stricter determinism and apparently accidental development are *not* mutually exclusive, but rather that their coexistence is more the rule in nature" (Peitgen, Jürgens, & Saupe, 2004, p. vii).

[91] Complexity science can be regarded as a challenge to the traditional linear programme of Newtonian science and its ideas of certainty, randomness and non-equilibration (Kuhn, 2008).

of mathematics, there are different forms of mathematics that can provide us with alternative frameworks of mathematics for conceiving visions of inclusive mathematics teacher education.

Informed by the view that there are different types of mathematics and thus there can be multiple ways of thinking, presenting proofs and communicating, I will use this opportunity to critique your narrow view of analytical language and the embedded pedagogy of mathematics education. I am not sure how you define analytical language, but I regard analytical language as a way of organising mathematics as a completed project through an unchallenged hierarchy of symbols, patterns and categories (Glas, 2006). Some characteristics of analytical language include: dualistic categorisation, linearity as coherence, intolerance of ambiguity and ambivalence, and syntax or language rules as given. Next, I will suggest some ways to liberate mathematics education from this notion of analytical language, thereby introducing some inclusive-alternative languages that can reconceptualise mathematics teacher education as an inclusive and transformative endeavour. Perhaps, you may not like this, but I would like to pursue contextualizing pure mathematics according to our local cultural practices. In this way, I will explore possible stages by which to develop an inclusive vision of contextualised mathematics teacher education of Nepal.

Deconstructing Extreme Analytical Language

Dear Prof Prescription, I would like to draw your attention to your call for privileging analytical language (and proof) in the teacher education program that we have been planning to launch. It seems to me that you are still hanging onto the 18-century clockwork mentality that mathematics is all about using muted symbols and algorithms to make claims of certain knowledge (Kline, 1982). I would like to urge you to come out of this archaic mentality that does not help harness an empowering use of mathematics via creative, meaningful, agentic and inclusive pedagogies (Orr, 2002; Skovsmose & Valero, 2001). Why don't you realise that our teachers need creative and inclusive visions of mathematics education rather than the exclusive call that they need to stick on to the language that maintains the clockwork order of mathematics (Hayles, in Doll, 1993)? Let me start unpacking why the hegemony of analytical proof-oriented mathematical language in our teacher education program does not help conceive an inclusive mathematics teacher education.

I argue that your advocacy for privileging analytical language-inspired proof seems

to promote the technical interest. The notion of technical interest is about maintaining control and hegemony through the distorted language of mathematics (Taylor & Campbell-Williams, 1993). Here, the meaning of distorted language entails a language that is bureaucratic and divorced from contexts. Reflecting upon my experience of undertaking a unit, *Real Analysis*, during my first Master's studies, I remember most of us (Master's students) following the pathway of rote-memorisation of theorems and their language of proof as we could not understand the meaning and application of various concepts being presented due to the use of highly bureaucratised (abstract, structured and technical) language. Had we been supplemented by a life-world oriented language, we would have made sense of mathematical concepts presented in the unit. As a result of a bureaucratised language, the knowledge of mathematics was almost inaccessible to all of us. In my mind, another feature associated with your exclusive promulgation of analytical language reflects the interest of reproducing the hegemonic culture embedded in the mathematics that privileges the Modernist outlook (or the Western Modern Worldview). How can we expect pedagogic creativity from teachers without encouraging them to embrace multiple worldviews (and logics), as harnessing creativity seems to demand working from within, beyond and across several frameworks (Semetsky, 2008)?

Next, your emphasis on the hegemony of analytical language is problematic for me because I do not buy into the idea that dualistic worldviews embedded in analytical language (as discussed by Willmott, (1999) in the context of sociology of education) is an appropriate response to the pluralistic, mosaic and multiplistic features of the Nepali educational world. Your exclusive emphasis on analytical language is more akin to maintaining the prevailing view of school mathematics as a discipline exclusive to academically bright students. Indeed, such a narrow view embedded in mathematics education does not promote meaningful learning that may be effectively inculcated by incorporating students' lifeworlds in day-to-day pedagogical activities. Thus, the exclusivity embedded in your analytical language is a stumbling block for making sense of mathematics from embodied, cultural, historical and critical vantage points (Almeida & Joseph, 2007; Lakoff & Nunez, 2000). Let me share a snippet of my experience of facilitating a workshop on using locally available 'low-cost' educational materials in teaching mathematics. I requested participating teachers to come up with at least three possible ways of solving a problem related to the estimation of the total number of leafs of a palm tree whose picture was presented to the workshop. Very few of them came up with multiple methods of estimation (e.g., Van de Walle, 2004) whereas the majority were adamant that different ways of solving the same problem would confuse them and their students. What might be the source of such singularity? I argue here that an exclusive emphasis on analytical language is likely to be a source of hegemonic singularity in mathematics teacher education.

Whilst critiquing the hegemony of analytical language, I am also aware that I have also used its features in my inquiry. Does this mean that I am promoting a contradiction between my advocacy and practice? Perhaps, I am not promoting such a contradiction as I do not advocate replacing analytical language by other types of languages as a means of representing knowledge claims. My critique here is directed at the exclusive emphasis on analytical language that does not seem to promote contextualised mathematics teacher education.

Conceiving Emancipatory Pedagogic Languages

Bewildered by your suggestion of getting rid of empowering pedagogical means, I would like to clarify my idea of emancipatory pedagogic languages embedded in reflective practice, collaborative learning, and critical pedagogic envisioning of a contextualised mathematics teacher education. Here, my notion of language entails both noun and verb forms of it to account for multiple textualities inherent in any context of language enactment (Bauman & Briggs, 1990). Furthermore, I hold the view that language is not merely a collection of mute symbols but a vast reservoir of worldviews and perspectives (Kawasaki, 2007). In my mind, emancipatory pedagogic languages provide teachers and teacher educators with opportunities to question the hegemonic posture of analytical language that is not inclusive of pedagogic languages that can help conceive an inclusive, agentic and contextualised mathematics education. Indeed, your emphasis on analytical language seems to demonstrate your desire to promote technical interests in mathematics teacher education by privileging the view of the nature of *mathematics as a body of pure knowledge*, thereby making it impossible to conceive an agentic and inclusive vision of mathematics teacher education that prepares teachers who can employ various ways (including both contextual and transcendental) of expressing mathematical concepts, facts, definitions and proof. What can be a viable alternative that helps transform mathematics teacher education from such exclusivity to an empowering endeavour?

He Never Quoted His Parents I

He produced a lecture. He
told us mathematics is difficult. He
positioned himself up there. He
looked at us down here. He
symbolised us as subjects. He
quoted Western mathematicians. He
never quoted his parents.

He used harsh words. He
took an hour to eulogise the capital M. He
harassed the young people. He
preached his dogma. He
situated himself within the territory of capital M. He
did not see our potential.

He intimidated everyone of us. He
drank two cups of water. He
used abstract mathematical concepts. He
didn't challenge Whitehead or Russell. He
was condescending of schoolteachers. He
never quoted his wife.

He said, "Research in Mathematics is difficult. You
have to stop eating while doing mathematics. You
have to stop mundane thinking while doing mathematics. You
have to be away from nasty reality while doing mathematics. You
have to be an alien while doing mathematics. You
have to forget yourself while doing mathematics. You
have to think about mathematics all the time. You
have to be an isolated hermit to be a mathematician."

Dear Prof Prescription, I am elaborating four additional pedagogic languages so as to rescue mathematics teacher education from the conundrum of disempowering pedagogies arising from your narrow view of analytical language. These four languages can be regarded as the language of empathy, critical-reflection, inclusion and envisioning. Let me explain how these languages can help turn control-propelled mathematics teacher education into an empowering enterprise. I argue that the language of empathy helps mathematics teachers and teacher educators to connect themselves with learners' lifeworlds (Brownlee & Berthelsen, 2006). Unlike the remoteness of self from other in your analytical language, an empathetic language helps bring self and other in proximity with each other (Dow, Leong, Anderson, & Wenzel, 2007). Therefore, it can be this language that help teachers understand their students' struggles in making sense of mathematics, thereby developing appropriate strategies to facilitate their learning process. Perhaps, you may not like the language of critical reflection as it challenges the hegemony of anything including your exclusive emphasis on analytical language (Penny, Harley, & Jessop, 1996). Please try responding to this moral question of our time: Are we teaching mathematics for the sake of analytical language (and the nature of mathematics generated by it) or are we teaching for its usefulness in the present and future lives of all students? I argue here that if we are not able to prepare our teachers to help students connect mathematics with their lifeworlds, it may be difficult to justify the need for including mathematics as a 'core subject' in the school curriculum. I believe that, with the use of critical reflective language, mathematics teachers will be able to identify the limitations of the realist posture embedded in the analytical language of mathematics (Down & Hogan, 2000). Being aware of boundary conditions of the mathematics that we teach is helpful for thinking about alternatives which can help mathematics education be inclusive. I

He Never Quoted His Parents II

He implied that we cannot be mathematicians. He
predicted that we would be bad losers. He
made use of his oxymoron capital M theorems. He
made us sleep. He
tried to convince us that capital M is all powerful. He
did not quantify its power though. He
told the grand story of his mathematics. He
did not use humorous language. He
required us to be serious. He
never quoted his daughter.

He told us that children's maths is not capital M. He
dismissed the '..gogy' business. He
advocated pure content. He
dismissed my presentation as untouchable. He
mythicised mathematical symbols. He
quoted self and many unfamiliar names. He
never quoted his son.

argue here that a critical reflective language helps teachers introspectively examine their own practices, thereby identifying deep-seated assumptions influencing their pedagogies (van Manen, 1995). In a similar way, why shouldn't we (you and I) embrace this language to reflect critically upon hegemonic ideologies that prevent us from thinking and acting inclusively and wisely?

Prof Prescription, we need yet another language so as to overcome the sometimes exclusive posture embedded in critical language. Perhaps, you know well the danger of critical language that, in the extreme, may not offer any positive or forward-looking perspective. I envisage that self-reflection can help pacify the extremeness of criticality by pointing the finger at self-practices (Gay & Kirkland, 2003). Next, a language of inclusion is about including viewpoints that may be opposing, contradictory and complementary. Perhaps, you know well that there are logics which help manage contradictions. Dialectical logic is one of them, and it reminds us of the holistic nature of phenomena in which fixed and changeable[92], permanent and transient[93], and self and other exist side by side. I hold the view that such a language of inclusion is about promoting the synergy and co-existence of sometimes opposing concepts (Slee & Allan, 2001). Does not this pedagogic language help us create an inclusive space for thinking about and acting for a meaningful, agentic and transformative mathematics education?

Next, a pedagogic language of envisioning can help teachers and teacher educators construct and reconstruct their visions of everyday pedagogical activities by uniting sometimes opposing constructs, such as feeling and logic, *formal* and *informal*, personal and social, and knowledge and wisdom (Gidley, 2007a). In my mind pedagogic envisioning is a culmination of empathy, critical reflection and inclusion, among others. I am not discounting possible uses of some aspects of your analytical

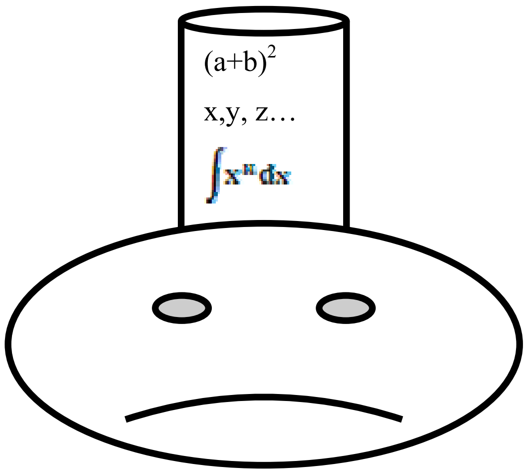
[92] In Shankhya Darshan, one of the six schools of Vedic Philosophy, *Purusha* and *Prakriti* are identified as fixed and changeable entities by which the universe operates (Brainard, 2000).

[93] Nagarjuna, a first century Buddhist philosopher from India, in his two-truth theory talks about the feature of transients being dependent co-arising whereas permanent not being dependant on others (Ramanan, 1975).

language which is oriented by conventional logics (propositional, deductive and analytical), and which promote a form of reasoning that exclusively progresses through building blocks of axioms, facts and conjectures as if they are the ends in themselves (see Section Four). These logics may be necessary but they are insufficient for the language of envisioning, for it needs to account for seen and unseen and reasoned and felt aspects of our experiential world (Palmer, 2003). How can a pedagogic language of envisioning help emancipate mathematics teachers and teacher educators from a narrowly conceived view of mathematics as an abstract, decontextualised and extremely algorithmic subject matter? I argue here that the language of envisioning is likely to: (a) offer mathematics teachers ways in which to create synergy between traditional-cultural (impure?: artefactual, embodied, communal, informal) and modern (or pure?: symbolic, algorithmic, abstract, formal) mathematics; (b) provide mathematics teacher educators with a referent for conceiving present and future pedagogies in a creative way; (c) help teachers and teacher educators act wisely and inclusively whilst working with students of varying cultural capitals; and (d) instil an inclusive and futuristic view of mathematics education rather than an exclusionary view of school mathematics as a subject for a select few students (Slaughter, 2008).

Contextualising Decontextualised (Pure) Mathematics

Dear Prof Prescription, what I am going to say here comes from my profound desire to transform mathematics education from its existing exclusive worldview to an inclusive futuristic vision. In my experience of studying Bachelor and Masters Levels of education in Nepal, pure mathematics hardly connects itself with the world outside of mathematics. Here, my notion of pure mathematics entails both the genre and the process of mathematics that has been very influential



in the field of teacher education in Nepal. In terms of genre, it can be characterised by a ‘cut and dry’ analytical expression, a language that is divorced from contexts, that promotes muted symbols and algorithms, and that relies on an abstract and self-referential representational system (Restivo, 1999). Here, my notion of self-referential representation entails that pure mathematics may not seek the empirical world for the verification of its theorems and definitions, rather it tends to promote a circularity of axiomatics in which each proven theorem becomes an axiom for the new unproven theorem (Confrey & Costa, 1996). In my experience of studying undergraduate mathematics units, the process of learning in pure mathematical units entails: copying from teachers’ notes, rote-memorising for exams and recalling during exams. How long should we let this situation remain unaddressed? Perhaps, you will agree with me that it will never be too late to start transformative thinking and actions, even for harnessing the power of pure mathematics in favour of Nepali students’ present and future lives.

Taking on board the multidimensional image of the nature of *mathematics as an im/pure knowledge system* (see Section One), I would like to put forward a four stage vision for contextualising decontextualised (i.e., pure: abstract, algorithmic-mechanical, symbolic) mathematics, thereby creating a space for a meaningful synergy between pure and impure (i.e., embodied, everyday, artefactual, informal) mathematics. I hope that such a vision will make pure mathematics more accessible for our teacher education program.

First, I would like us to think about a logic that can facilitate creating such a space that allows both pure and impure mathematics to be brought together. Can your analytical language-driven logics (i.e., propositional, deductive and analytical) be helpful in this endeavour? I think we need a set of inclusive logics that allow us to manage apparent contradictions generated by sometime opposing views of the nature of mathematics or forms of mathematics (Kolmogorov, 2006). From my perspective, dialectical logic enables us to generate an holistic pedagogic vision as opposed to a dualistic transmissionist vision. Through the image of im/pure mathematics, we can promote a synergistic relationship between more than two forms of mathematics, thereby harnessing the usefulness of mathematics in students’ present and future lives.

At the second stage, you and I need to think of ways of introducing an inclusive representational form of mathematics. In particular, my notion of representation refers to ways in which mathematical concepts, ideas, facts and conjectures are constructed, expressed and communicated (DeBellis & Goldin, 2006). Now we need to think about contextualising pure mathematics at the representational level, meaning that we need to embrace multi-representational ways of enacting mathematics in context. To do so we can introduce unconventional representational methods, including narrative, digital, visual/graphic and poetic, together with conventional representational means (Kaput, 1998). With the help of a narrative representational approach, mathematics teachers can facilitate their students to search for mathematical knowledge through their day-to-day cultural activities. You may agree with me that various unsolved mathematical problems (through conventional representational methods and analytical methods) are solved with the help of digital and graphical representations (e.g., the Four Colour Theorem of Topology). By contextualising through representational means, mathematics teachers are able to conceive the images of *mathematics as ever-developing, contingent* and *emergent knowledge systems*. Do not these images provide a referent for conceiving a much-needed vision for our inclusive mathematics teacher education?

As you and I arrive at the third stage, we are likely to facilitate teachers to conceive

and construct standards to assess or judge the quality of the process and product of mathematical tasks performed by their students (Romberg, 1995). I argue in favour of multiple and contextual quality standards rather than the unchangeable and hegemonic standards embedded in pure mathematics. Indeed, our standards need to reflect the dialectical (dependent co-arising) relationship between pure and impure mathematics, rather than one particular view of the nature of mathematics. It may be surprising for you to embrace multiple standards to judge the tasks performed by students because you have been advocating a one-size-fits-all approach to judging the quality of students' knowledge generation in mathematics. Can we advise teachers to use the same standards to judge the quality of algorithmic and visual proof? Can such an approach promote a social justice-oriented vision of mathematics education for all (Gutstein, 2006)? If our teachers bring multiple quality standards to assessing their students' task, this may encourage them to perform a variety of mathematical tasks.

In the fourth and final stage, we need to articulate well the epistemology(s) that we use for contextualising mathematics teacher education. Indeed, this stage of epistemological contextualisation is about unpacking ways of knowing by which we want to orient our teacher education program. In my mind contextualising mathematics teacher education in terms of ways of knowing requires us to transform your epistemology of reproducing the analytical language of pure mathematics to multiple ways of knowing mathematics through conversing, constructing, reconceptualising self and other, collaborative exploration, and problem solving in context. Perhaps, it can be at this stage of contextualisation that teachers and teacher educators think about their pedagogies in terms of ways of knowing, a meta-pedagogical level that helps teachers realise the pedagogic bases of their day-to-day classroom activities. I hold the view that an inclusive teacher education program needs to use sometimes opposing epistemologies in a synergistic way rather than a dichotomous way. Therefore, our vision of an inclusive teacher education program promotes the view that objective and subjective, constructive and deconstructive, and behaviourist and constructivist epistemologies co-exist side-by-side. In my mind contextualisation is not about a reductive epistemic standpoint rather it is about an holistic expression of values, systems, interests, lifeworlds and actions. In the case of our teacher education program, the notion of epistemological contextualisation refers to the embodied praxis of knowing in which chasms of thinking and acting, knowing and being, and believing and valuing form interactive and reflexive relationships (Núñez et al., 1999).

In this way I would like to invite you to conceive our mathematics teacher education in synergistic, creative and un/conventional ways. Synergistic approaches are helpful for conceiving mathematics teacher education in such a way that it accounts for our multi-lingual, multi-cultural and multi-logical realities. Perhaps, you will make necessary adjustment to your worldview to incorporate empowering perspectives of inclusive mathematics teacher education? I am hoping that you will accept my request for 'small c contextualisation' as a heuristic strategy for transforming our mathematics teacher education, taking it from an exclusive to an agentic and empowering program for teachers and teacher educators.

Sincerely yours

Bal Chandra

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Recapitulating the Present, Mapping the Futures

With the initial aim of deconstructing the hegemony of exclusive notions of globalisation, foundationalism and mathematical language in mathematics teacher education programs and constructing transformative visions for addressing them, this section has presented my narrative exploration in three chapters. In Chapter 14, I articulated two key disempowering features of globalisation as Westernisation and universalisation. Whilst recognising the positive meaning of globalisation as two-way border crossing, I envisioned a synergistic space of glocalisation that offers a space for incorporating sometimes opposing views, perspectives and notions related to mathematics teacher education. Chapter 15 reported my inquiry into the hegemonic influence of foundationalism in mathematics teacher education. In the same chapter, I identified ways to include both foundationalism and scepticism for transforming mathematics teacher education from a closed (and clogged) program to an open and democratic enterprise. I envisaged that such an enterprise is likely to promote dialectical logic as a means for establishing symbiotic relationships between scepticism and foundationalism, for foundationalism gives rise to scepticism, and *vice versa*. In Chapter 16, I deconstructed Prof Prescription's exclusive emphasis on analytical language (of mathematics) as the sole basis for representing mathematical knowledge. I argued that because of the narrowly conceived view of mathematical language, mathematics teacher education programs are less likely to incorporate contextual representational approaches to mathematical knowledge. Finally, I presented four possible ways of conceiving an inclusive mathematics teacher education program that promotes contextualisation at the logical level, the representational level, the level of quality standards and the epistemological level.

Section Six

In Section Seven, I will present conclusions of my inquiry, drawing from Section Zero to Section Six of this thesis. In this process, I hope to portray how I conceived and designed this research, thereby articulating my approach to generating small p philosophies (and small w wisdoms). Finally, I will explain how this research can benefit others (mathematics teachers, teacher educators and educational researchers) and me by means of the empowering notion of research as professional development.

SECTION SEVEN: CULMINATIONS

Orientation

Section Seven constitutes a single chapter that presents my reflections on the process (and product) of the inquiry. In Section Zero, I presented my goal through this inquiry as: to unpack key dimensions of the problem of culturally decontextualised mathematics education, thereby offering a vision for developing inclusive mathematics education. In each subsequent section, I have discussed issues and problems associated with the research questions, thereby offering a multidimensional vision for addressing the problem under investigation (e.g., unidimensional nature of mathematics, unhelpful dualisms, reductionist thinking, to name a few). Given the nature of emergent inquiry, various research questions emerged in the process of the inquiry. Section Seven presents a retrospective view of my inquiry.

CHAPTER 17: FINAL REFLECTIONS: LOOKING BACK, MOVING AHEAD

The chapter begins with a synopsis of how I explored the initial research questions for this inquiry. Employing the metaphor of *wring as journey*, I present my experience of unpacking the research questions via my biography as a student, teacher, teacher educator and researcher. Whilst unpacking my research journey, I elaborate the process by which I have come to realise the need for a multi-paradigmatic design space for this inquiry (Taylor, 2008b; Taylor et al., in press). More so, I discuss the inclusion of autoethnography and small p philosophical inquiry as methodological referents. After presenting the summary of my explorations, I discuss possible implications of this inquiry for others and myself.

Recapitulating My Research Aims

My journey of inquiry began with the excavation of my own biography as a student, teacher and teacher educator. I generated my initial research questions on the basis of my history as a student of primary, secondary and university level in Nepal, my master's project (Luitel, 2003), and my professional experiences as a teacher educator in a university of Nepal between the years 2004 and 2006. This autobiographical excavation explored various dimensions of the key research issue *that is* the hegemony of culturally decontextualised mathematics education. Whilst excavating, I encountered a number of images of mathematics, such as foreign subject, subject without heart, lifeless subject, to name a few. Constructed on the basis of my primary and secondary education, these images continued to occupy the textual space as I arrive at my bachelor and *first* master levels of education with more critical moments to be accounted for. Exploring my professional experiences as a teacher trainer of an in-service teacher education program reminded me of a hesitant shift from my earlier narrowly conceived nature of *mathematics as a body of infallible knowledge* to an inclusive nature of *mathematics as human activity*, despite widespread narrowness among schoolteachers and university professors with whom I work. By this time, my exploration gave rise to one aspect of the key research problem through this initial research question: *Which nature of mathematics orients the school mathematics education and mathematics teacher education of Nepal?*

Reflecting upon the process and product of my Master's project that I undertook in 2003 and that unpacked curricular and pedagogical aspects of the research problem of culturally decontextualised mathematics education in Nepal, I further convinced that the issue of the nature of mathematics needs another level of exploration with a host of transformative ideas at my disposal[94]. Re-reading my narrative exploration of pedagogical practices of mathematics education that I portrayed in my Master's research project reminded me of much exclusionary and unidimensional thinking governing mathematics education in Nepal, such as exclusively teacher-centred pedagogy, centralised curriculum practices and the *reproductionist* agenda of mathematics education. This process of retrospective reading gave some insights into dualistic and reductionist 'thinking models' orienting the culturally decontextualised mathematics education in Nepal.

Travelling through the virtual world of reflecting upon my experiences, a number of already conceived (through my Master's project) and *new* kinds of problems began to appear in my mind's eye. Whilst exploring my conversations with a number of principals of private schools of Kathmandu Valley during the preparation stage of a one-year in-service teacher education program in 2004, I felt that many unhelpful dualisms (e.g., content versus pedagogy, teaching versus learning, pure versus impure mathematics) contribute to strengthen the ongoing decontextualisation of mathematics teaching and learning activities in many Nepali schools. In this way, a new set of initial research questions took shape as: *What may be some unhelpful dualisms that promote a culturally decontextualised mathematics education in Nepal? In what ways does dualism orient mathematics education in Nepal?*

Arriving at the middle of the year 2004, when I started lecturing students of the one-year in-service teacher education program, a series of episodes unfolded depicting how I grappled to help students realise the need for a multi-perspectival view of

[94] Such ideas arise from dialectical logic, integralism, critical mathematics education, to name a few.

mathematics education. Retrospectively, reading my students' assignments, observing their classes and facilitating their school-based projects reminded me of rampant unidimensionality in conceiving mathematics teaching, learning and assessment practices. As I began to explore these aspects of my experiences, I saw a déjà vu all over again: *reductionism is the in/visible in-charge of everyday classroom practices as it was in my life as a student*. This aspect of my experiences gave rise to this initial question: *In what ways does reductionism orient mathematics education in Nepal to become an elitist and exclusive enterprise?*

My textual construction of my experiences arrived at the nodal moment of being involved in a curriculum committee to revise one of the mathematics curricula of Nepal. It was this experience in the year 2005 that provided me with the opportunity to realise disempowering implications of the widespread image of *mathematics curriculum as subject matter* for the pedagogical practices of mathematics education. Interacting with curriculum officers and committee members reminded me of the problem that lies in the unidimensional modernist model of curriculum development. Arriving at this stage, I formulated this initial question: *In what ways is the mathematics curriculum in Nepal guided by disempowering assumptions about reality, knowing, language and thinking?*

Another stop that I arrived at in this exploration was the moment of becoming involved in formulating a two-year mathematics teacher education program for the University of Himalaya in 2005. Through this exploration I realised that a host of narrow views of globalisation contribute to sustain culturally decontextualised mathematics teacher education. This situation gave rise to this initial research question: *What might be the narrow views of globalisation that orient the mathematics teacher education program?* Exploring this situation further, I encountered yet another in/visible ideology of foundationalism which appears to be an obstacle for developing an inclusive mathematics teacher education program. Inscripting this critical moment gave rise to yet another initial research question: *In what ways is an exclusive foundationalism unhelpful for conceiving an inclusive mathematics teacher education?* Travelling through the journey of writing about myself, I felt a déjà vu all over again as professors and teacher educators, who I consulted with during the formulation of the teacher education program, opined for promoting the purity of mathematics by emphasising exclusively analytical language of mathematics (abstract and symbolic genre of mathematical proof, definitions and overall 'expression' to be embedded in mathematics teacher education courses). Reflecting on this nodal moment of my professional history gave rise to this initial research question: *In what ways does analytical language of mathematics promote culturally decontextualised mathematics education in Nepal?*

Arriving at the beginning of 2006 a number of issues began to emerge in my reflective textual space. I vividly remembered a series of discussions with my students about some heretical philosophies of mathematics that upheld the nature of mathematics as a fallible knowledge system. Writing about this moment helped me realise that I overly favoured capital P Philosophies of mathematics rather than practice-based philosophising *in* or *for* context. It occurred to me that I was following the conventional hypothetico-deductive logic as an in/visible means of privileging Philosophical Ideas over practitioner-generated ideas. Reflecting upon this situation led me to this initial research question: *What are the key orienting logics of mathematics education in Nepal?*

As my experiences continued to appear in this textual space, I found myself addressing students' dissatisfaction resulting from the didactic pedagogy of tutors of some mathematics units of the newly launched teacher education program of the University of Himalaya. Rebuffing my request to be more inclusive and student-centred in their teaching, the tutors replayed the same old tape: *It is because of the nature of mathematics. We can do nothing about it.* And, I felt the déjà vu of exclusively algorithmic, abstract and decontextualised mathematics all over again. Thus, the question, '*Which nature of mathematics does orient mathematics education in Nepal?*' became prominent in my inquiry.

In this way my initial plan of investigating the phenomenon of culturally decontextualised mathematics education in Nepal was expanded in terms of its various dimensions. Such dimensions are expressed through the following key questions of my research.

RQ1 What may be key unhelpful dualisms that uphold a culturally decontextualised mathematics education in Nepal? (see Section Two)

RQ2 In what ways does reductionism orient mathematics education in Nepal to become an elitist and exclusive enterprise? (see Section Three)

RQ3 In what ways is the mathematics curriculum in Nepal guided by disempowering assumptions about reality, knowing, language and thinking? (see Section Five)

RQ4 What might be the narrow views of globalisation that (dis)orient the mathematics teacher education program? In what ways is an exclusive foundationalism unhelpful for conceiving an inclusive mathematics teacher education? In what ways does the analytical language of mathematics promote culturally decontextualised mathematics education in Nepal? (see Section Six)

RQ5 What can be the key orienting logics of mathematics education (curriculum and pedagogy) in Nepal? (see Section Four)

RQ6 Which nature of mathematics orients mathematics education in Nepal? (see Section One)

Reflection on My Research Journey

Multiple paradigms

I began this research project sometime in the first week of August 2006. In the first part of my journey, I was overly guided by the 'outward' critical paradigm. The notion of outward criticality indicates an emphasis on 'others' as if I am separated from the 'other' phenomena of my study. Consequently, I paid due attention to critiquing phenomena outside of me as if everything was wrong out there. Of course, this paradigm was needed to critique various hegemonies that arise from, and are embedded in, decontextualised mathematics education. Nevertheless, I soon realised that I am also part of the socio-cultural system, and thus an exclusive promotion of externality may have an alienating effect. This realisation gave rise to the inward critical paradigm which helped me to be critical of my own distempering thinking (false consciousness) and actions. Thus, critical self-reflection became one of the key elements of my research design.

The process of constructing my research design took me further by embracing multiple selves and characters. As I began to reflect upon my educational practices, I became more aware of multiplicities within me. As viable strategies for depicting multiplicities embedded in my practices, I chose multiple genres to express, multiple logics to make sense of and multiple methods to facilitate my inquiry. With the view of promoting narrative and performative imagination as epistemic techniques, I began to generate data texts (e.g., van Manen, 1991) and to construct reflective narratives on the basis of my experiences. Now, the dualism of the researcher and researched was transformed into multiple forms of the selves of the researcher (i.e., my selves). In this way, I strived to employ creative and constructive dimensions of the postmodern research paradigm in my research design.

In the process of creatively using multiple research genres and subscribing to multiple research logics, I realised that an exclusively fixed, pre-determined research design does not help much in accounting for emergent epistemic activities. Arriving at this point of my excavation, I felt that I needed the interpretive research paradigm so as to account for emergence in my writing (Guba & Lincoln, 2005). This emergence was not only about methodological labels but also about research questions, issues and agendas. Another importance of the interpretive paradigm lies in developing interpretive perspectives about issues embedded in my research questions. More so, the interpretive paradigm made me aware of the ‘evolving’ use of theories and perspectives to interrogate issues embedded in my research questions.

I constructed data texts and interpreted them from my experiential and theoretical standpoints. So what? Indeed, this did not seem to represent the complete goal of my inquiry: I wanted also to explore possible alternatives to the problem of culturally decontextualised mathematics education widespread in the educational system of Nepal. I felt that I needed somewhat holistic thinking (not ‘grandiose’ though) in my research design so that I could construct visions about solving the problem of culturally decontextualised mathematics education faced by Nepali students. Arriving at this stage, I felt that a better vision requires humility, synergy and synthesis, which appear to be the salient features of integralism (Wilber, 2000c, 2007). In the meantime, I came to know about dialectical logic as a tool for uniting adversaries and opposites.

After conceiving such a multi-paradigmatic design space and having explored various theoretical perspectives, my initial research questions were widened with an added emphasis on envisioning as addressing research problems and issues. In order to facilitate the process of envisioning, I felt that I also need integralism with an emphasis on holism, synergy and humility. It could be this research paradigm that brought a number of ideas from Eastern Wisdom traditions to my design space, such as Vedic and Buddhist dialectics, nondual view of reality, post/essentialist view of language, metaphors and poetics, to name a few. Arriving at this stage of my inquiry, the following research questions were crystallised as a call for constructing visions for addressing issues and problems arising from the research questions.

- How can key unhelpful dualisms be addressed for envisioning inclusive pedagogical spaces? (see Section Two)
- In what ways can mathematics education in Nepal embrace a multi-logics perspective for developing an inclusive mathematics education? (see Section Four)
- In what ways can I develop a transformative curriculum vision for a mathematics education that is inclusive of knowledge traditions arising from people's practices? (see Section Five)
- What are likely to be key perspectives that overcome exclusionary views (globalisation, foundationalism and decontextualised mathematics education) for conceiving a vision of an inclusive mathematics teacher education? (see Section Six)
- How can an inclusive nature of mathematics be conceived as a basis for a transformative vision for an inclusive mathematics education? (see Section One)

After conceiving integralism as the rationale for a much needed multi-paradigmatic space, I soon realised that I was also using three features of the positivist research paradigm, such as propositional logic, metaphysics of presence and some degree of control over my research project (Kincheloe & Tobin, 2009; Laudan, 1996). I might have rejected positivism on the pretext that these minor 'elements' were not very effectual in my research. However, I chose to be inclusive and fair in terms of ideas borrowed from diverse paradigms. Consequently, I came to realise that propositional logic has its relevance in this academic space where I have to produce this thing called a 'thesis' which needs clearly articulated advance organisers, and a form of propositional writing. Even if I employed narrative writing, I needed to 'propose' and 'declare' a point (or points) where I needed to stand. Next, control is another feature that is attributed to positivism, and that has a place in my inquiry. Indeed, the doctoral candidacy proposal served partly as control. And, my studentship is another form of control. Although I used a different form of empiricism, some aspects of positivism were impossible to reject, such as the use of direct evidences arising from my experiences as a student, teacher and teacher educator.

Methodological referents

Initially, I conceived ethnography as the main methodology of my research. Perhaps, I was tempted to use 'mainstream' and 'normal' research methodology that would help me speak a common language. Consequently, I felt a kind of contradiction -- more than a contradiction, a paradox – which was this: I am addressing problems that are related to my personal-professional practice, and yet I want to design my research to focus exclusively on Others. As I became immersed in the postmodern paradigm, I began to see a number of possibilities about using a more appropriate methodological label in relation to the personal-professional nature of my research problems. Now, I needed a methodological label or labels that could account for my emphasis on data generation, narrative construction and imagination as an epistemic technique. In this way autoethnography (Spry, 2001) gained prominence as one of my methodological labels.

Making a gradual move into the integral paradigm, I began to realise that autoethnography was still incomplete in terms of my emphasis on developing visions for addressing problems and issues arising from my research questions. But, my emphasis on vision-making was not about generating what Erickson calls 'assertions'(Erickson, 1986). Indeed, I was interested in generating imaginings with reflexivity and humility. With this view, I reapproached the methodology literature to find another possible label that could account for this aspect of my knowing. Whilst reviewing the notion of Philosophical Inquiry (PI), it occurred to me that I was not actually researching about 'capital P' Philosophies or Philosophical Ideas, rather my emphasis was on philosophising (i.e., envisioning) through my practices. Can it be called philosophical inquiry? Well, I called this 'small p' philosophical inquiry because my act was not about claiming absolute Philosophical Truth. This does not mean that I have rejected all 'capital P' Philosophies; rather, I used them as a means for promoting interactivity with my evolving subjectivities (sic). More so, the use of dialectics, poetics, metaphors and other logics facilitated the process of my envisioning a multidimensional nature of mathematics, inclusive pedagogical approaches, transformative curriculum vision, spaces of glocalisation, and multi-logical pedagogical spaces, to name a few.

Use of theories and perspectives

In this research, I used a number of theories and perspectives as a source of crystallising my ideas. Similar to my experiential perspectives, theoretical perspectives helped enrich my creative understandings about issues under study. However, I did not use any theoretical perspectives exclusively as frameworks, rather I employed them as referents. I believe that referents do not rigidly 'frame' the researcher but enable him/her to view the world from multiple perspectives. More so, referents are different from frameworks in terms of the relationship between the researcher and theories used in the research.

Whilst applying theories and perspectives as referents, they became visible to me and my readers. Therefore, by employing various theoretical perspectives as referents I became reflexively aware of my evolving subjectivities. Here, I have not taken subjectivity as the opposite of objectivity, for one dependently co-arises from the other and both of them exist side-by-side (or both of them are labels; they mean nothing at a certain level of our consciousness). More so, my emphasis had been on the interactivity between my experiential perspectives and perspectives arising from theories and ideologies. Such a space of interactivity offered me ways to perform various forms of imaginings as a key basis for envisioning.

Similar to the view that the idea of referent helped to cultivate my evolving subjectivities, it also helped generate inter-objective (i.e., between external ideas) knowing between the wide range of theories and perspectives. I have used the term inter-objective so as to represent the interaction between those which exist outside (sic) of my experiences. Again, I was equally aware that such a face value meaning of inter-objectivity might not capture a much needed complexity at a higher level of understanding, for it might be difficult to separate between inter-subjectivity (i.e., between internal subjects) and inter-objectivity.

Quality standards

I constructed six standards by which to judge the quality of the product and process of my inquiry. The standard of <u>incisiveness</u> puts emphasis on the extent to which my research problems are articulated clearly in terms of the key research problem. Arising from the post-modern arts-based research tradition (Barone & Eisner, 2006), this quality standard does not talk about a cut-and-dried sense of the clarity of focus; rather it implies the degree to which the research process and product are intelligible. Also arising from the same tradition, the standard of illuminating asks this question to readers of my thesis: 'Are meanings of concepts, ideas and phenomena under study enriched, deepened, made vivid, and made more complex?' These standards became the basis for foregrounding the view that educational research agendas, such as culturally decontextualised mathematics education, and subsequent emergent agendas, are not simplistic, rather they are complex, multidimensional and *complicated*.

The third quality standard that facilitated my research is verisimilitude, a radical shift from the view of reality as correspondence to the view of reality as viable textual construction (Denzin, 2003a). So, this quality standard replaces the notion of unchanging Truth with viability of truthfulness (Ellis, 2004). Being truthful is not about claiming to have uncovered the unchanging and reified Truth, for it is difficult to claim to have discovered exactly the same experience that I encountered some years ago. The moment of writing always infects the way I experience it. Thus, I ask my readers: 'If the standard of verisimilitude is addressed, do my stories sound true, seem real and reflect aspects of your experiences?' Arising from the interpretive paradigm, my next quality standard is transferability which is about the extent to which my research process and product are transferable to another context (Guba & Lincoln, 1989). I tried to address this quality standard by providing rich details of contexts on which the inquiry is based.

Whilst subscribing to the notion of research as reading, I used pedagogical thoughtfulness as yet another standard by which to judge my research text (van Manen, 1991). With this quality standard, I hope to have increased the likelihood of readers being engaged in my genres, thereby being thoughtful about their deep-seated pedagogical assumptions, beliefs and values. As explained elsewhere, I employed critical reflexivity, which is about making my own subjectivities (creative personal views) visible to readers. Arising from the critical paradigm, this standard helped me generate perspectival visions (Ellis & Bochner, 2000; Freshwater & Rolfe, 2001). Finally, I chose wisdom as yet another quality standard with an emphasis on going beyond unhelpful dualisms associated with knowledge claims (Henderson & Kesson, 2004; Maxwell, 2006). Arising from the integral paradigm, this standard helped me become less presumptive and inclusive of adversaries associated with issues under study (Wilber, 2007).

'Small p' philosophy or 'small w' wisdom: An Overview of Sections

Conventionally, this part of the chapter could be regarded as the space for portraying assertions of findings and recommendations as if the researcher has accessed the infallible Truth. I do not claim myself to have gotten that far; I have come to know something about my practices as a teacher, researcher and teacher educator. Indeed, this process of knowing helped me understand dilemmas, issues and problems that I have encountered thus far in my personal-professional life. The idea of 'findings' entails the meaning that knowledge is out there waiting to be found or discovered; this view does not inclusively reflect the nature of the inquiry that I undertook. More so, my thesis generated new learnings and wisdoms (not simply confirming known knowledge) via innovative epistemologies that have the goal of deepening understanding of normal educational practices by critically examining them, identifying underpinning (invisible) assumptions, and reconstructing them through scholarly interpretations and re-imagining. Similarly, my emphasis was on exploring personal practical knowing, an approach to philosophising my professional experiences. In a nutshell, this research represented a journey of learning about my own professional experiences. Let me summarise my learnings (small p philosophies and small w wisdoms) that I generated so far.

Im/Pure mathematics

Whilst inquiring into the nature of mathematics (i.e., RQ 6) that promotes an exclusive decontextualised mathematics education, I unpacked mainly two adversarial images of the nature of mathematics: *mathematics as a body of pure knowledge* and *mathematics as impure knowledge*. Based on my experiences as an undergraduate student, university lecturer and teacher educator, I came to realise that the nature of *mathematics as a body of pure knowledge* is widespread in mathematics teacher education and school mathematics education. Whilst articulating this nature of mathematics, I took the term 'pure' to represent a range of forms of mathematics, such as algorithmic, abstract and *formal*, to name a few. With the help of narrative and performative imagination, I explored how this nature of mathematics can be unhelpful for incorporating mathematics arising from students' lifeworlds in mathematics teaching learning activities. In the same way, my inquiry also came up with some disempowering features embedded in the sometimes opposing nature of *mathematics as impure knowledge*, although this nature of mathematics is more inclusive of mathematical knowledge systems arising from people's practices. Here the term impure portrays forms of mathematics associated with embodied, artefactual, *informal* and ethnic knowledge, to name a few. To resolve the apparent dichotomy of pure versus impure mathematics, I used different forms of dialectics to generate an inclusive and multidimensional nature of *mathematics as an im/pure knowledge system*, where im/pure represents an inclusive space generated through the dialectical relationship between pure and impure mathematics (see Section One).

Dualisms

Moving to the research question (RQ1), 'What may be key unhelpful dualisms that promote a culturally decontextualised mathematics education in Nepal?' I began with the aim to construct meanings of dualism via literal definitions, metaphors and poetics. With the view that dualism is a tendency to classify concepts, statements and events according to duals, as belonging to only one of two all-encompassing, mutually-exclusive categories with essentially fixed meanings, I came up with a number of unhelpful dualisms (e.g., content versus pedagogy, teaching versus learning and pure versus impure mathematics) as a stumbling block for transforming mathematics pedagogy from an exclusive teacher-centred practice to a participatory pedagogical enterprise. In this process of envisioning, I discussed how the Western Modern Worldview has been un/wittingly promoting a dualistic worldview in the pedagogical landscape of mathematics education, thereby favouring an exclusively decontextualised mathematics education in Nepal. Guided by the epistemic technique of narrative imagination, I employed thirdspace and dissolution metaphors as a basis for conceiving an inclusive pedagogical space to overcome the hegemony of unhelpful dualisms (see Section Two).

Section Seven

Reductionism

Responding to the research question (RQ2) 'In what ways does reductionism orient mathematics education in Nepal to become an elitist and exclusive enterprise?' and other emergent issues about reductionism, I started my journey of exploring different ways of conceiving of reductionism as prevailing in the field of mathematics education, such as reductionism as ideology, methodology and logic. With the help of the epistemic technique of performative imagination, I constructed performative narratives to demonstrate how different forms of reductionism have strengthened a culturally decontextualised mathematics education in Nepal. In this process, I critiqued those different forms of reductionism, thereby constructing narrative visions about addressing issues of exclusive reductionism embedded in the mathematics pedagogy and curriculum of Nepal (see Section Three).

New and old logics

Addressing the research question (RQ5) 'What can be key orienting logics of mathematics education (specific to curriculum and pedagogy) in Nepal?', I unpacked and elaborated three conventional logics (propositional, deductive and analytical) with examples of how my pedagogical practices as a conventional teacher and a radical teacher educator were influenced by them. With the help of narrative imagination, I discussed key features of propositional, deductive and analytical logics in relation to their impact on my pedagogical praxis. In the process of conceiving alternative logics, I envisaged possible uses of metaphorical, dialectical, narrative and poetic logics whilst conceiving inclusive pedagogical visions that go hand-in-hand with the multidimensional nature of *mathematics as an im/pure knowledge system* (see Section Four).

Curriculum issues

The research question (RQ3) 'In what ways is the mathematics curriculum in Nepal guided by disempowering views, perspectives and assumptions?' led me to explore my experience of interacting with curriculum workers representing people from the Curriculum Planning Office and other educational institutions related to teacher education. By using a performative genre of letter writing, I came to realise that the mathematics curriculum in Nepal is guided by the assumptions that reality is best described through the assumptions of static equilibrium, that knowing is possible through rote memorisation, and that mathematics is a value-free subject. I examined how these disempowering views can become stumbling blocks for conceiving an inclusive mathematics education in Nepal. Given these disempowering notions of mathematics curriculum, I constructed a transformative vision of mathematics curriculum. In order to construct such a vision, I employed a number of theoretical referents, such as integralism, complexity science, *new* logics and curriculum images, to name a few (see Section Five).

Globalisation, foundationalism and narrow view of mathematical language

Addressing three research questions (RQ4), 'What might be the narrow views of globalisation that orient mathematics teacher education program?', 'In what ways is an exclusive foundationalism unhelpful for conceiving an inclusive mathematics teacher education?' and 'In what ways does the analytical language of mathematics promote culturally decontextualised mathematics education in Nepal?', I examined the disempowering views of *globalisation as Westernisation* and *universalisation* and their hegemonic impact on mathematics teacher education. In my envisioning, I offered an inclusive space called glocalisation, an expression of dialectical relationships between globalisation and localisation (sic). Whilst critiquing an exclusive emphasis on foundationalism that promotes decontextualised thinking in mathematics teacher education, I explored ways to create synergy between scepticism and foundationalism via dialectical thinking. Addressing the third question 'In what ways does analytical language of mathematics promote culturally decontextualised mathematics education in Nepal?', I critiqued the unidimensionality embedded in the exclusively privileged analytical language. More so, I argued that privileging one form of mathematical language does not help fully realise the much needed inclusivity in mathematics education. In order to resolve this problem, I presented a multi-level vision by means of which to develop an inclusive mathematics teacher education. Such a vision offers possibilities for conceiving a contextualised mathematics education through logical, representational and epistemic levels (see Section Six).

Section Seven

Implications for Others

If I do not speak about possible implications for others (i.e., the mathematics education community, curriculum committees, teachers, teacher educator), I may be termed a narcissistic who is overly concerned with his own self-pride and self-interest. Nevertheless, my implications need not be conceived as full and final assertions, rather they can offer a set of insights into the problem of culturally decontextualised mathematics education faced by students in Nepal (and probably in other places with contextual similarities). I have constructed these implications under two topics: eagle and mouse views. An eagle view is a way of speaking from macro-level perspectives, whereas a mouse view offers micro-level perspectives.

(a) Eagle view: In an effort to construct visions for addressing the problem of culturally decontextualised mathematics education, I came up with a number of visions for conceiving an inclusive mathematics education. Primarily, I envisaged that my vision of a multidimensional image of the nature of *mathematics as an im/pure knowledge system* can become a key orienting nature of mathematics for conceiving much needed inclusive pedagogical and curricular spaces for mathematics education (see Section One).

Next, with the aim of illuminating further the proposed inclusive pedagogical space, I constructed inclusive pedagogical visions via the thirdspace and dissolution metaphors as an attempt to address unhelpful dualisms prevailing in the landscape of mathematics education (see Section Two). More so, whilst discussing different forms of reductionist practices embedded in the hitherto exclusive and elitist view of mathematics education (due to the hegemony of decontextualised mathematics education), I offered visions for conceiving an holistic and inclusive pedagogical and curriculum practices (see Section Three, Four, Five). I argued that such visions further help illuminate the much-needed dimensionality and explanatory possibilities of the inclusive pedagogical space that can act in concert with the nature of *mathematics as an im/pure knowledge system*.

My discussion and articulation of a transformative vision of the mathematics curriculum (see Section Five) can add the much needed curricular dimension to such an inclusive pedagogical space. Guided by an inclusive image of *curriculum as montage*, such a vision of curriculum can become a basis for incorporating different forms of knowledge systems arising from the nature of *mathematics as an im/pure knowledge system*. In the process of constructing the curriculum vision, I envisaged a set of logics (e.g., dialectical, metaphorical and poetic) that offer holistic, inclusive and non/dualistic thinking strategies needed to conceive and articulate such a transformative vision of curriculum. Similarly, I envisaged that with the help of dialectical logic, the field of mathematics education can shift from many dualities to inclusive-holistic thinking, whereas poetic logic can help offer ways to unpack ineffability embedded in such an inclusive space. More so, metaphors can help extend the reach of concepts and ideas beyond the literalistic creed.

In the context of globalisation becoming an influential issue in mathematics education, my articulation of glocalisation can be a timely endeavour for harnessing an empowering and inclusive view of globalisation for mathematics education. The notion of glocalisation is likely to provide an inclusive space for addressing competing and yet complementary interests of globalisation and localisation (sic) in mathematics education. In this way, glocalisation can provide an explanatory compass for developing empowering pedagogic visions for formulating a mathematics teacher education program as a transformative endeavour. The idea of transformation entails structural shifts in thinking and actions, thereby promoting a critical, creative and holistic approach in all aspects and levels of teacher development in mathematics education.

(b) <u>A Mouse View</u>: Speaking from a mouse view, my research can become helpful for teachers who wish to transform their day-to-day pedagogical practices from teacher-centred pedagogies to inclusive and agentic pedagogies. For this, they may employ some of my research texts (e.g., stories, interpretive-reflective texts) as referents for developing transformative visions for their teaching contexts. For example, the story about my observation of teacher-centred teaching (see Section One), the envisioning of possible non/dualistic pedagogies through the thirdspace metaphor (see Section Two), the performative text of Pratap's reflective journey of applying radical ideas in his teaching (see Section Three), and two key stories about my roles as a conventional teacher and radical teacher educator (see Section Four) can offer insights into transformative pedagogies that every mathematics teacher can construct and apply in their everyday classrooms.

Next, I envisage that mathematics educators of similar professional contexts portrayed in my thesis can use my research texts as a referent for transforming their professional practices. For instance, my stories of Section One can encourage teacher educators to think about their own deep-seated view of the nature of mathematics and its possible consequences in their teaching. I am not saying that holding an inclusive view of the nature of mathematics can guarantee the use of inclusive pedagogical practices in their everyday teaching. Nevertheless, being aware of an inclusive nature of mathematics may increase the likelihood of subscribing to inclusive pedagogical approaches. More so, my research texts (e.g., stories, interpretive-reflective genres) of Sections Two, Three and Four of this thesis can be helpful for teacher educators in creating holistic pedagogies that pacify the exclusivity of unhelpful dualisms and ruthless reductionisms.

Finally, I envisage that prospective researchers can use my research process and product as an exemplar that uses a researcher's professional experiences as the research field *from which* to generate the data. I am not saying that the methodology that I have used here should be replicated. Indeed, I hold a view of research as fostering unique creativity. Nevertheless, it is possible that contextual, epistemic and methodological similarities can encourage other researchers to follow similar trajectories of inquiry into their professional practices. Specifically, other researchers can benefit by: (a) learning the process of my inquiry that has demonstrated my reflexive growth over the period of the inquiry; (b) knowing my treatment of various theories as referents which enables researcher to be aware of the boundary conditions of the theories; and (c) the diachronic and thematic representational approach that has helped me be creative and emergent about my thesis structure.

Implications for Myself

Indeed, what I have articulated as possible implications for others can also be implications for my future professional practices as well because I am also the 'other'-- a teacher, teacher educator and researcher -- in some ways. Besides, as a result of this inquiry, I have identified disempowering forces (dualistic logics, reductionist thinking, exclusive nature of mathematics) orienting my practice as a teacher and teacher educator. By being aware of such forces, I hope to have developed some useful means for addressing them in my present and future professional practices.

As I mentioned elsewhere in this chapter, I have indentified dialectical, metaphorical, and poetic logics as means for envisioning an inclusive pedagogical space. I hope to employ these logics for reconceptualising my personal and professional practices, thereby becoming more conscious of what I think about how I act in my role as a teacher educator. Primarily, I hope to address disempowering forces of dualism and reductionism via dialectical logic which offers inclusive ways to articulate a hyphenated, hybrid and non/dual (e.g., self-other, I-we, self-culture) approach to thinking and acting in professional contexts. More so, I envisage that dialectical logic can help illuminate my complex positionality as a teacher educator who needs to co-act and co-perform within an array of competing interests and ideologies. Through the dialectics embedded in Eastern Wisdom traditions I have realised the need to expand myself from an unnatural narrowness if I am to act inclusively and holistically. Here the notion of unnatural narrowness refers to limited categories that may be imposed on my identities and life-roles.

With the help of metaphorical logic, I hope to articulate my present and future professional practices beyond the literalist hegemony of ‘is-ness’. Nevertheless I am not dismissive of ‘is-language’, rather I have become aware of the limitation of its essentialist emphasis. With the help of metaphorical logic, I can understand my practices from a range of possibilities arising from a non/essentialist view of self and other. Indeed, metaphorical logic helps me articulate a multilayered view of self. Here non/essentialism refers to a dialectical relationship between essentialism (things have unchanging essences) and non-essentialism (essences do change). More so, poetic logic is also helpful for me to articulate the ineffable dimension of my actions which may not be portrayed through the rigidity of the hypothetico-deductive thinking of mainstream academia. I have re-educated myself through some aspects of Eastern Wisdom traditions which promote the view that poetic thinking helps an individual to embrace elasticity, inclusivity and humility by which to realise the full potential of being human. Thus, I envisage that poetic logic is likely to pacify possible rigidities embedded in my thinking and actions, as the Tao emphasises:

Section Seven

> At the birth of man (*sic*) he is elastic and weak; at his death rigid and unyielding ... So then rigidity and hardness are the stigmata of death; elasticity and adaptability of life. He then who putteth from strength is not victorious even as a strong tree fulleth the embrace. Thus the hard and rigid have the inferior place; the soft and elastic the superior
>
> (Crowley, 2005, p. 94, in Tao Te Ching)

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