

FRACTALS OF 'OLD' AND 'NEW' LOGICS: A POST/MODERN PROPOSAL FOR TRANSFORMATIVE MATHEMATICS PEDAGOGY

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We would like to be clear that we are not 'philosophical postmodernists' in the sense that postmodernism is concerned exclusively (obsessively perhaps) with deconstructing 'grand narratives', whether they be injurious, benign or beneficial. Our standpoint is akin to Donald Polkinghorne's (1992) notion of 'constructive postmodernism' which values pluralism over universalism but avoids the philosophical 'game' of espousing moral relativism. We are first and foremost educators whose theorising is grounded in our practice (as teacher educators, teacher-researchers, parents, partners, poets, human beings, etc.), and so we situate ourselves in and of 'the swamp' while simultaneously maintaining a fascination with the transformative world of Ideas. We work creatively with the tension between modernism and postmodernism, represented as 'post/modernism', where '/' denotes the dialectical relationship between these antinomic paradigms. We see them as mutually constitutive, in much the same way as are light and dark, masculine and feminine, life and death, up and down; it makes no sense to be forever honouring only one side and dismissing (fearfully) the other. This allows us to embrace paradox, uncertainty and playfulness, and to countenance both traditional and alternative ways of making sense of the world.

From this perspective (which we have at times labelled 'critical constructivism'; Taylor, 1998) we have been addressing the goal of reconceptualising mathematics education for bettering (cf. battering) the lives of rural Nepali students whose experiences of mathematical learning for the most part are not pleasant because of the curriculum dominance of culturally de-contextualised mathematics; a totalising ideology (or taken-as-natural grand narrative) that projects the official image of *mathematics as a body of pure knowledge* (Luitel, 2009; Luitel & Taylor, 2010). The term 'pure knowledge' refers to a host of normalising labels such as 'abstract', 'formal', 'algorithmic' and 'standard', to name a few. In placing undue emphasis on *teaching as transmitting a body of pure knowledge* and *learning as rote-memorisation of what has been transmitted by teachers*, this unilateral view of the nature of mathematics allows only (at best) half a story to be told about pedagogical possibilities in mathematics education. This narrowly conceived but globally dominant image of mathematics, supported by its allied metaphors of teaching and learning, embodies a mode of reasoning based on conventional (or old) logics that serves to: (a) ascertain absolute Truth, (b) impose contextualised categories onto the pedagogical world, and (c) portray ideas, concepts and perspectives with the help of dualistic thinking that divides ideas into mutually exclusive parts, privileging one over the other.

Our purpose in writing this paper is to help deconstruct the hegemony (while not dismissing the value) of conventional logics that govern established pedagogies of culturally de-contextualised mathematics education worldwide, with a special focus on the culturally diverse nation of Nepal. Shifting away from the modernist notion of logic as an instrument for categorising, ordering and legitimising certain forms of human reasoning (Chakraborti, 2006) - linear, assertive, deductive, dichotomised, non-allegorical, symbolic-tautological -

towards an inclusive notion of logic as a means of accounting for and representing diverse profiles embedded in human consciousness (Rorty, 1988), we explore features of *old* and *new* logics as a means of envisioning a culturally inclusive mathematics pedagogy. Here, the notion of ‘diverse profiles’ depicts different aspects of consciousness - personal, social, cultural, empathic, emotional, literal, non-literal, objective, subjective, conceptual, perceptual - embedded in the eternal territory of body, mind, heart and soul (Semetsky, 2008).

The first section of the paper begins with a story of the first author’s (Bal Chandra’s) experience of teaching *Mathematics Education*, a unit designed for students studying a masters degree course at the University of Himalaya (a pseudonym). The story exemplifies the pedagogical impact of conventional logics whose disempowering features are subsequently explored in relation to his lived experience as a mathematics teacher and ‘radical’ teacher educator. The second section starts with a story based on an informal discussion with Bal Chandra’s masters students, one of whom is critical of his alternative heretical¹ view of the nature of mathematics. The remainder of this section considers pedagogical implications of new (Eastern and Western) logics - metaphorical, poetic, dialectical, narrative – for creating a culturally inclusive mathematics education, especially in the context of Nepal. Throughout the paper, different forms of ‘transgressive’ texts are used (Guba & Lincoln, 2005) - images, narratives, stories - to portray the imaginative spirit of this narrative inquiry. Images have been juxtaposed against the text as visual metaphors for assisting the reader to reflect on different ways of thinking mathematically (Taylor, Luitel, Désautels, & Tobin, 2007).

I. 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 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 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 Ernest², but I will also use others’ ideas if necessary.

¹ The idea of heretic views of mathematics emanates from a host of philosophical ideas which challenge the Platonist and Formalist views of mathematics. These views include mathematics as a contingent knowledge system, mathematics as activity, and mathematics as an impure knowledge system.

² I had used Paul Ernest’s (1994) book, *Mathematics, education, and philosophy: An international perspective*, as the main text for this unit

Probably my presentation won't take longer than 45 minutes. The remaining hour or so will be dedicated to 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 the meantime, the two missing students arrive in 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.

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 lovely sunset. I swiftly bring my eyes back to the classroom so as to show that I am well focused on 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 the colourful screensaver projected 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 the 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 a time- and space-free notion of 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 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 nature 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.

Creating a Landscape

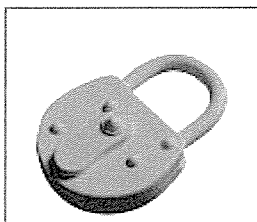
The above story depicts my experience as a radical teacher educator striving to develop an inclusive and transformative vision for mathematics education in Nepal. By storying my experiences, I am re/creating my professional landscapes with a host of frames and spaces that have been closely associated 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, 1994), Radical Constructivism (Cobb, 1994), Ethnomathematics (D'Ambrosio, 2006) and Critical Mathematics Education (Skovsmose & Valero, 2001) provides me with a bumpy site for critical reflection on my own pedagogical thinking and actions. I use the metaphor of ‘bumpy site’ to indicate potentially disempowering paradoxes and contradictions that often prevent me from acting inclusively to transform mathematics education in Nepal. What might be such disempowering paradoxes and contradictions that are prevalent in my approach as a radical teacher educator? Can they be propositional, deductive and analytical logics (henceforth called ‘conventional’ logics) that appear to be unwittingly orienting my actions as a teacher and teacher educator? Perhaps I say yes to this question because it appears to me now 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.

With these questions in mind, my task in writing this paper is that of a confessional protagonist who shares his experiences of the disempowering nature of key conventional logics that prevent mathematics education from becoming culturally inclusive. By constructing stories of my pedagogical practices as a teacher and teacher educator, I shall generate insights into how the exclusive use of conventional logics may hinder the development of a transformative mathematics education. This epiphany encourages me to explore the meanings, historical evolution and disempowering features of conventional logics via a reflective-storied genre.

Constructing Meanings of Old Logics

It seems to me that hypothetico-deductive thinking promotes dualism via its emphasis on narrowly conceived analytical logic which becomes a source of many unhelpful dichotomies. In what follows, I articulate these three *old* logics (i.e., propositional, deductive and analytic) 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

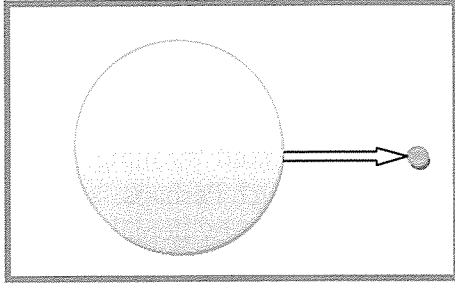
explanations that are imputed upon realities around us (Tieszen, 2005). Perhaps, this logic caused me to largely ignore the value of context in the process of radicalising mathematics education because of its insufficiency in accounting for complexities associated with the notion of context. Although my heretical perspective of 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 are the main features of propositional logic which 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 a single fixed meaning, thereby depicting it 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 landscape 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: Deductive logic can be explained as a process of moving down from unchanging ethereal principals to context-based examples as if the later are always at the mercy of the former (Goldstein & Brennan, 2005). The metaphor of moving down depicts 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 to 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 (e.g., Walshaw, 2004). Perhaps, I might have been colonised by this 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 promotes an orderly view of reality in which so-called general principles and rules are mapped onto a host of unique local narratives³ (Egan, 1997).

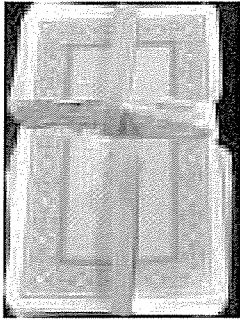
In my mind, another notion of deductive logic entails the metaphor of controlling the periphery (the particulars) by the centre (the universals). What does the notion of centre represent in my meaning of deductive logic? Upon reflection, the so-called centre is represented by rule-, formula-, principle-like statements (Long, 2001), whereas practice-based narratives are situated at 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 logic that my narrative self was constantly agitated by my exclusive privileging of the ‘centre statements’ generated via philosophical perspectives which un/wittingly subdued the narratives embedded in the students’ and my own lived realities.

Now my journey of constructing meanings of deductive logic arrives at a detour: my experience as an undergraduate student who strived to make sense of many theorems of calculus. It may be that because of deductive logic, among other conventional logics, I was not able to think outside of a 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 controls 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 resulted 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, that is, short-term personal pleasure that barely helps in sustaining long-term happiness (or Shreyas) (Muller, 1955). It seems that my exclusive use of deductive logic contributed to depicting mathematics education as an exclusive-elitist enterprise, thereby not rendering it as a source of Shreyas for my students.

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 we divide up conceptual constructs into a number of components thereby privileging a few of those categorical components (Wolcott, 2001). For instance, the above story depicts how I was

³ Kieran Egan regards this phenomenon as philosophical understanding which is strongly guided by assertive and deductive logics.

unknowingly separating the conventional view of mathematics from the heretical view as if they are really separate, demarcated and cordoned off. Does this logic not promote a one-sided view of reality? Might analytical logic not have contributed to yet another exclusive view of mathematics education?



Let me explore further the 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 had got that right because, according to the logic that I had embedded in my 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 two extreme 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 otherwise. However, there appears not to be much difference between the logic that governs anti-heretics and my heretical self in relation to the nature of mathematics. Perhaps, in having been colonised by analytical logic, there is a Himalayan-size difficulty in realising that the phenomenon of establishing 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 emphasises the belief that mathematics education is fixed, unchangeable and static.

Constructing Unhelpful Features of Old Logics

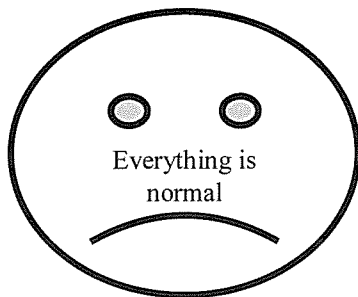
Although my writing in the previous section might have explicated some features of the conventional logics, I am planning to explore them in greater detail and depth. Can I not be allowed some degree of repetition and redundancy so as to make better use of the holistic nature of narrative representation? 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) **Hegemonic Control:** Why do I consider control as one of the main features of conventional logics? Reflecting upon my experience as a ‘conventional’ mathematics teacher in a school in Kathmandu in the early 1990s and as a radical mathematics educator sometime in 2006, I 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 - theorems, formulas, mathematical definitions, algorithmic solutions - via an impositional warrant of propositional logic. This teacher image does not seem to be much different from an authoritarian ruler who tries to control his/her subjects through thought-to-be unchangeable propositions (or 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 strongly influenced 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 truths⁴(Ernest, 1994). 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 logic, it seems that I was 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 the



possibilities for my students’ to observe and interpret 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 represents (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?
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

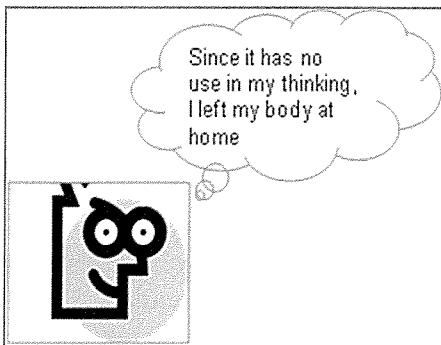
If someone says
You can find meanings in-between and beyond
Tell him/her that this is just a mythical mayhem
Because our evidentiary frame-eyes cannot prove them

So don't talk about ever unprovable

⁴ Whilst teaching the theorem, ‘angle sum of triangle is 180° ’, I did not pay attention to the fact that 180° is an ideal; I did not allow students to explore for themselves that 180° is an ideal approximation. Rather, I put emphasis on making sure that they got 180° as the result of verification.

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?

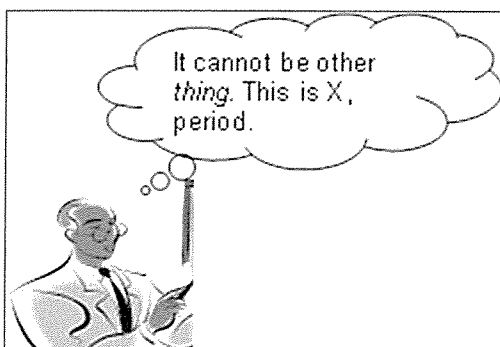
b) Disembodied knowing: “Can you stay alive without your bodies?” An anti-Cartesian self inside me raises this question after reading the famous Cartesian dictum that our mind is disembodied (Lakoff & Johnson, 1999). The means by which Rene Descartes arrived at this conclusive dictum appears to be the propositional logic embedded in his philosophical discussion, the deductive logic entrenched in his verificatory mode of knowledge claim, 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. Perhaps I privileged the dry and cold voice of the grand-narratives found in 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 prepares 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 needed to chart my pedagogical journey by holding these opposing categories in 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). Those assertions do not seem to have been inclusive of narratives of local practices, rather they were disembodied claims similar to those 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 presented coherently the world of Ideas, the further I separated 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 the window to an inclusive view of mathematics education. In a nutshell, analytical logic seems to have provided me with the 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 or 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 in 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, namely, 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 the 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 logic did not allow me to go beyond a 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.

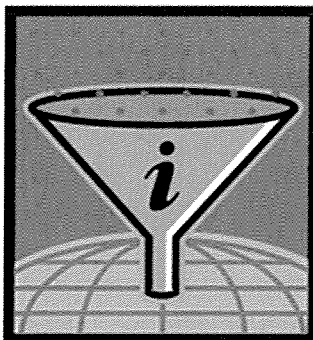
Did I, as a radical mathematics educator, try later to minimise the hegemonic influence of essentialism arising from an ontology of naïve realism? Although I was promoting the view of mathematics as a contingent knowledge system, the logics in my pedagogy might have essentialised mathematical reality 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 have been 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 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). 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/essentialist⁵ view of mathematics for a culturally 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 deep-seated notion of rationality as an act of producing seamless ideas as if there are no jolts and joins in 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 ghosts of Plato,

**Rational logic filters
impure thinking**



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 distancing 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, 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 unwittingly embedded in my preaching. Although I was arguing for an alternative powerful view of mathematics that can serve as a referent for a culturally inclusive mathematics education in Nepal, it seems that I was unwittingly endorsing a dispassionate, disembodied and de-contextualised cognitive

⁵ Non/essentialism represents a dialectical relationship between essentialism and non-essentialism, in which an entity can be perceived inclusively 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.

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, but they seem to have run along a rather unsustainable track of reasonableness created by a conventional logics-inspired language game. For me, the notion of an unsustainable track of reasonableness indicates a 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. Although in my radical teaching of the *mathematics education* unit I was challenging the apparent source of the assertive ‘knowledge paradigm’, I seem to have been unaware of the major source that enforces an exclusive view of rationality restricted to assertive-deductive-analytic thinking.

II. Journeying with New Logics: Creating Transformative and Inclusive Pedagogies

Pythagoras and Euclid are Still Useful!

It can be any late afternoon in the month of April, 2006. Probably after five classes of the mathematics education unit that 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 nature of mathematics that I have been professing in the class. Imagining that the informal talks and chats can help establish good rapport with students, I enthusiastically sit on one of the chairs attached to the table around which four students are 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 in 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 shaking up this rather conservative knowledge system”, Ramesh continues chewing on af Samosa. “I think the unit challenges our existing assumptions about mathematics that we teach almost every weekday.”

Ramesh’s response is not unsurprising because he has been my student since 2004, first in a year-long diploma in education program and now in a master of mathematics education program. 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 to the heretic camp after four/five sessions of my teaching and 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 have opted in only 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 three years' experience teaching mathematics in a secondary school. He often claims to know 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 roti⁶ 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 masters 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 arched eyebrows.

"Euclid and Pythagoras have used a particular framework, a flatland-smooth view of a 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 rhetoric that I have been using for the last three years. "Unless we replace this framework of a flat mathematical surface by an empowering framework of fuzzy, curved and non-smooth mathematical surfaces it is really hard to 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?"

⁶ Local bread made out of rice flour

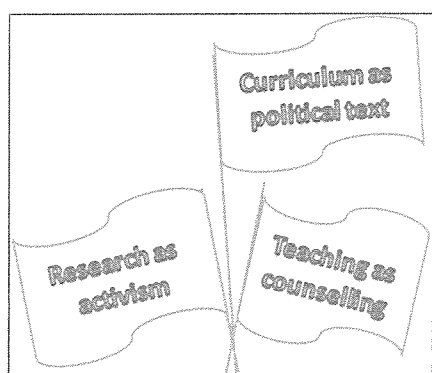
Don't we need flatland in our life, ever? Don't we need different types of mathematics to solve contrasting problems in our life?", a rather quiet Shambhu speaks passionately.

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 the 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?

Setting the Scene

Shambhu's questions keeps on coming to the fore in 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 for exploring possible new logics for a culturally 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 actions 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 is 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 post-formal 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, post-formal or post-literal) logics, but I am planning to explore metaphorical, narrative, dialectical, and poetic logics in relation to my (thinking and) actions as a teacher and teacher educator.



Metaphorical Logic

A definition of metaphor entails its notion as making sense of one concept in terms of a 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 to 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 key features of metaphorical logics by using my lived realities as a teacher educator and a mathematics teacher. Perhaps my searching for features of metaphorical logic is also “metaphorical” in the 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 going beyond the literal definitions of mathematical terms and concepts, yet not excluding totally the literal aspect of mathematics. This holonic⁷ transcending of essentialism by non-essentialism could have contributed to developing a layered understanding of mathematical concepts. My idea of holonic transcending of 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 logic. 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, non-universal, contextual - as if they were *real* entities. Perhaps, my approach of exclusively celebrating heretical views of mathematics could have emanated from a narrow literalism 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* 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,

⁷ Inclusion of lower conceptual and perceptual categories into higher order consciousness (Wilber, 2000b).

students might not have experienced anxiety because fullest possible use of metaphorical logic allows openness and creativity in interpreting phenomena available to us.

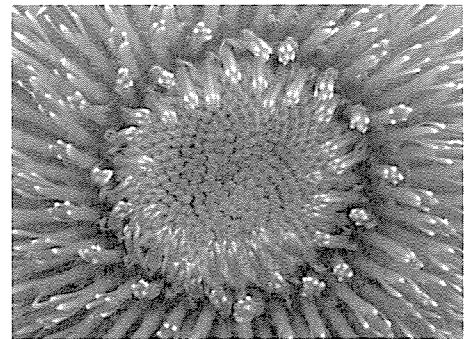
b) Embodied realism: This important feature of metaphorical logic helps generate a view of realism that accounts for our lived experience, one of the bases for making educational endeavours meaningful. Unlike the exclusive use of narrow literalism, which promotes a correspondence theory of truth and accounts for only apparent meaning of concepts, the use of metaphorical logic accounts for conscious (i.e., literal), subconscious and unconscious meanings of a concept under consideration. Perhaps it is appropriate to mention Lakoff and Johnson (1999) who 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 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 more 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 that metaphorical logic plays 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 logic can help generate multi-layered meanings and interpretations of mathematical concepts, thereby unpacking their various dimensions. 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 their hearts, bodies and souls.



My role as a transformative teacher educator could benefit from this feature of metaphorical logic in many ways. Perhaps, embodied realism can be an empowering referent for capturing practices of my students whose experiences as teachers are likely to generate unique, contextual and pragmatic visions for transforming mathematics education from its Platonic-elitist posture. In a similar line, embodied realism could help negotiate various views of mathematics. The diversity of conceptual images and imageries could be 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 (Lakoff & Johnson, 1999).

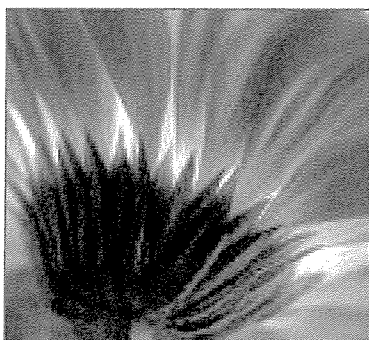
b) Imagining through multi-schema profiles: Metaphorical logic is about imagining through multiple schema-profiles concepts under consideration. Unlike the conventional logics, which

are exclusively based on a ‘*what is*’ mode of thinking, metaphorical logic can be used for 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 should 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 logic 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 the apparent meaning of layered pedagogy via 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 nature of mathematics, thereby creating a mosaic canvas of imageries and images.

Poetic Logic

Born to a family that adheres largely to Vedic, Buddhist and Animist beliefs and that 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 logic 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 (i.e., analysis), Eastern wisdom traditions prefer to promote poetic logic inspired genres as a means for generating and disseminating knowing and knowledge (Mahony, 1998).

As I read a (neglected) history of Western science, my mind's eye was captured by the idea of Giambattista Vico, a contemporary of Newton, who appears to critique 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 logic 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) Relationality and connectedness: 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) 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 logic could help promote a relational approach to dealing with different mathematical concepts. Rather than 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 co-generating mathematical knowledge from the personal, social and cultural milieus of students. By considering this feature of poetic logic as a referent for my pedagogy, I may be able to connect between pure and impure mathematics, thereby helping my students to understand the creative multidimensionality of the 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



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 logic can present to me as a teacher educator is a realisation of the 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 aspects of my experiences which could not be accounted for by the conventional logics inspired prosaic and assertive language game. 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 logic has to deal with God or some ethereal power, rather I am arguing

for the use of poetic logic as a means for expressing various forms of ineffability resting 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 (Obeyesekere, 2012). Indeed, it can be this feature of poetic logic that helps 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 my students are 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) Imaginative, emergent and creative realism: 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 poetic logic (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 help 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 words⁸ pertaining to poetic logic convey its meanings as association with the creation of higher knowledge.

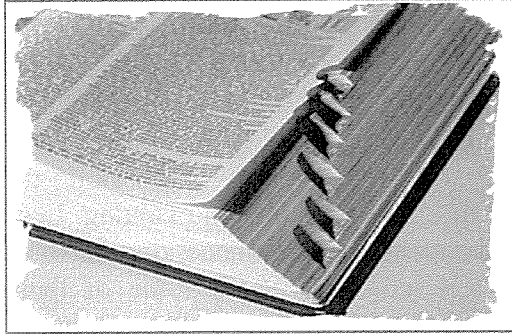
Considering poetic logic as a referent for my pedagogy, I might be able to open doors to an imaginative approach to mathematics teaching. Through this feature of poetic logic, I could help my students think of what might be possible, not compactly guarded by the view of the world embedded in naïve realism. By doing so, I could construct images of being different types of teacher (and students), thereby preparing myself for a poetic approach to embracing pedagogic roles⁹ that could transform the hearts and *atmas*¹⁰ of my students. This is equally important for my role as a teacher educator who would like to develop a cohort of teachers to help transform thousands of students. With the idea that pedagogical reality is emergent, I

⁸Literature (poetry, fictional writing, etc.) (Sahitya: साहित्य) means association, connection, combination, union of self with other; Poet (कवि) means seer, sage, prophet, wise, creator

⁹Multiplicitous, associative, collaborative.

¹⁰A Sanskrit term, a possible translation of which is soul.

could embody how conventional assembly-line pedagogical modes are insufficient to account for creative-imaginative dimensions of the 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 be less presumptive, open and inclusive toward different images 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 interpretive and interactive language. Vico's idea of reading the world from within language as a mirror of social and cultural dispositions and the Vedic idea of finding the world in Word seem to indicate the interactive and interpretive nature of language embedded in poetic

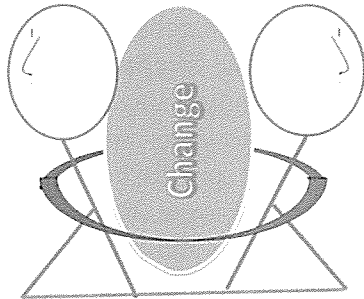
logic. Perhaps Vico was critiquing the exclusive literal-assertive and non-porous nature of language sprouting from the worldview generated via Cartesian-Newtonian language games (Fleener, 2005; Fleener, Carter, & Reeder, 2004). Poetic logic embedded in various Vedic texts seems to conceive language as a means for cultivating various dimensions of being (Sri Aurobindo, 1970). Indeed, poetic logic 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 logic 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 promotes an inclusive approach to mathematics teaching. Does this mean that I was not previously 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 better represented by poetic logic inspired language. 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, it is about embodying uncertainties in my pedagogical language. Thirdly, it could be poetic logics embedded language that help me in bringing musicality, aesthetics, emotions and contours of inner and outer experiences to my classroom activities, thereby promoting an interactive and interpretive language game (Gerofsky & Goble, 2007). Last but not least, a poetic logic inspired language could help me be minimally presumptive and judgemental, thereby

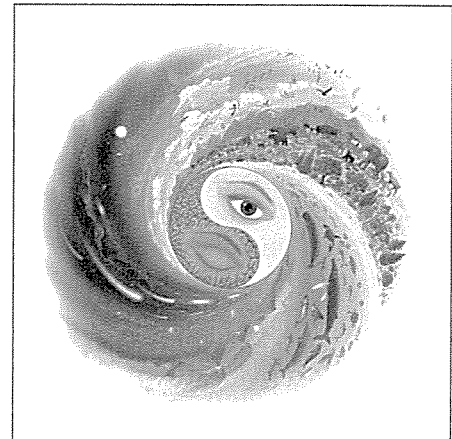
expanding my boundaries of heart and mind beyond the ‘a priori’ nature of Philosophical understanding. Nevertheless, I am not trying to say that philosophical understanding is not important; rather, I am critical of the exclusive mapping of ‘generic grandiosity’ onto my (and my students) unique lived experiences.

Dialectical Logic



For me, dialectical logic is the logic of synergy in which different (often antagonistic) qualities, objects and conceptualities are held together (Giegerich, Miller, & Mogenson, 2005; Wong, 2006). Contrary to the *old* logics’ approach to promoting a dualistic worldview, various forms of dialectical logic seem to promote integrative, holistic and inclusive worldviews arising from the notion that antagonisms are inherently inseparable and co-arising. Speaking from my lived experience, dialectical logic is 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 it 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. 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 logic, I could be able to generate a synergy between ‘pure’ and ‘impure’ mathematics. 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)¹¹. 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 logic can be a pragmatic tool for correcting the problem of being exclusive of local cultural practices of people for whom mathematics education has been intended. 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 come from different social and cultural groups in terms of their ethnicity, culture and parents’ occupation. I could invite them to explore how 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 feel included in terms of their contribution to knowledge generation. Perhaps, the next step would be to create synergies between their lived mathematics and the mathematics embedded in the textbook. What could

¹¹ Ole Skovsmose talks about the two-dimensional nature of dialectical thinking which can bring informal and formal mathematics into the classroom.

that synergy be? Perhaps, it would be their multilayered and multi-profiled understandings about mathematical concepts. As a teacher educator, dialectical logic could help overcome unhelpful dualisms embedded in my thinking and practice and enable me to embody an inclusive pedagogic vision for incorporating different images representing the multidimensional nature of *mathematics as an im/pure body of knowledge*.

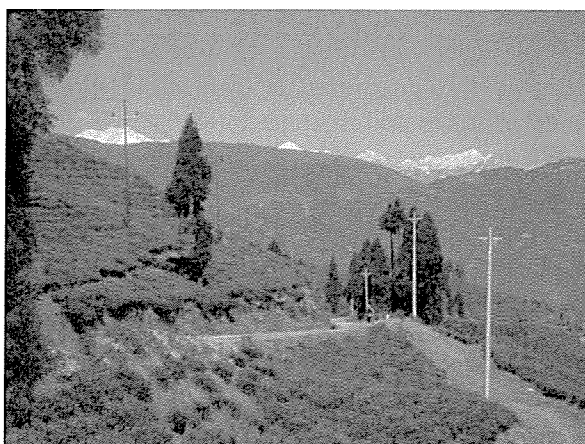
b) Non-duality: Different forms of dialectical logic from the East and West (maybe also from the North and South) seem to have a common view of reality in terms of the inseparableness of the subject and object, known and knower, self and other. In the initial stage of this inquiry, these ideas challenged my un/conscious assumption about knowing, being and valuing as exclusively separate entities. Re-excavating¹² my cultural, professional and personal narratives, as well as going through others' texts about dialectical logic, has 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 logic 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 the 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 entails a process of renunciation of various status quos. In retrospect, I needed to suspend the conventional logics inspired authoritarian pedagogy whereby my students relinquished aspects of their passivity. Drawing both of us close to a *third space* would be helpful in reducing the border.

How could this feature of dialectical logic be useful for my role as a teacher educator? Rather than interpreting as nonnegotiable categories, such as pure and impure, universal and contextual, and impermanent and permanent, I could regard these categories as part of the ever-changing impermanent world. How could I take these impermanent categories as permanent? Beside this, the notion of non/duality could play an important role for maximising the participation of my participants in planning and implementing the curriculum of the *mathematics education* unit 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.

¹² My first excavation has taken place drawing an autoethnography(Luitel, 2003) for exploring my lived experiences as a student, teacher and teacher educator.

c) Eco-pedagogical imagination: As I begin to explore this feature of dialectical logic, an image of an unbounded, green and multiplex pedagogical landscape appears in my mind's eye. Choosing such 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 practice 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 ecological 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 logic, 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 grand-narratives embedded in different philosophical traditions.

Narrative Logic

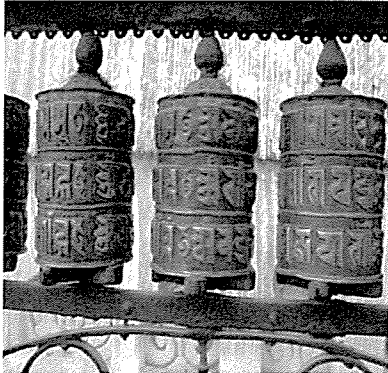
Unlike the selfless text that is promoted by the exclusive form of conventional logics, narrative logic seems to promote the text embedded in my 'self' (and selves) playing various roles, from teacher educator to active citizen (Walshaw, 2009). In the North American history of qualitative research, narrative logics inspired texts seem to have arisen after the post-structural 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 the very young history of narrative logic inspired texts in social research, narrative logic appears 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 the selfless contours of assertive, deductive and analytical logics to an embodied telling, re-telling and restructuring of my pedagogical enactment. Given this notion, I am about to explore some key features of narrative logic bringing forth my experience as a mathematics teacher and a teacher educator.

a) Activity as expression of meaning: With this feature of narrative logic, 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 algorithmic 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 logic, 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 logic, I would be developing various activities that help generate contextual meanings of mathematics through stories, parables and theatrical representations. As a teacher educator this feature 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 *mathematics education* unit 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.



b) Lived reality: Contrary to an excessive emphasis on searching for reality outside of one's own life, narrative logic 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 de-contextualised 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 logic 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 offers me a host of perspectives for enacting my pedagogy more 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. 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 embrace an exclusively dogmatic view of *mathematics as a pure, indubitable and certain knowledge system*. Furthermore, it might be through this feature of narrative logic that an inclusive view of mathematical knowledge and knowing makes a significant impact in the field of mathematics education by helping students see contingent but useful forms of mathematics interacting in their lifeworlds. Does this mean that narrative logic does not value universal and objective truths? Rather than speaking from yet another dualistic standpoint, 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 logic 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 logic could help reconceptualise my pedagogy via the lens of cultural imagination (Baldwin, 2006)¹³. 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.

Final Thoughts

You say you want a revolution
Well, you know
We all want to change the world
But when you talk about destruction
Don't you know that you can count me out
(Revolution by The Beatles, 1968)

¹³ 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.

Too often the academic world is riven with antagonisms. Witness the paradigm wars as qualitative researchers asserted their right to practice humanistic methods alongside (or, for many, instead of) quantitative researchers practising naturalistic science methods. Or the proponents of constructivist learning environments vying for (and often wanting to take control of) the instructional space dominated by behaviourists. Or the sociocultural theorists calling for curriculum inclusion of indigenous knowledge systems to counterbalance (or eliminate the colonial legacy of) the Western Modern Worldview that for centuries had suppressed the language, customs and knowledge systems of indigenous peoples worldwide. In this paper we set out to illustrate the ease with which revolutionary zeal for transforming the landscape of mathematics education, so that it becomes more humanistic and culturally inclusive, can lead however to unhelpful and unnecessary antagonism.

We have identified the source of this antagonism as the dominant and naturalised (or hegemonic) set of conventional logics. We illustrate how propositional, deductive and analytical logics serve to cement in place an exclusive form of *mathematics as a body of pure knowledge* which serves a narrow range of sociocultural and geopolitical interests. Indeed, conventional logics were equated with mathematics *per se* by the Logician and Formalist schools seeking to establish the philosophical foundations of mathematics. To excel in this classical mathematics education one needs to enter a world of abstract symbolic logic largely dissociated from everyday social reality and allow examination fervour and a vision of a Western-oriented university education to fuel one's 'playing the game'. In this way, an exclusive form of the Western Modern Worldview is reproduced which, in turn, governs the image of mathematics as a body of pure knowledge to be transmitted to culturally compliant students. A humanist would bridle at this inequitable, unfair and socially unjust neo-colonial spectre, and would seek to overthrow the regime. As did the first author in his professional practice as a 'radical' mathematics teacher educator.

In the second part of the paper, we have illustrated (with irony) the ease with which a transformative minded radical teacher educator can be hijacked by the coercive power of conventional logics as he skilfully endeavours to deconstruct the hegemony of pure mathematics in the minds of his postgraduate students and replace it with a culturally inclusive form of 'impure mathematics'. Sensing his students' and his own mounting discomfort with the logic of antagonism that he is un/wittingly employing in his radical teaching, he eventually finds a way to conceptualise a rapprochement in the form of 'im/pure' mathematics. This potentially peaceable outcome is a consequence of his discovery of a range of logics (relatively) new to mathematics education – metaphorical, non/essentialist, poetic, dialectical and narrative logics. The significance of this discovery is that these new logics are embedded in Nepali cultural traditions, making them highly accessible to Nepali scholars and teachers of mathematics wishing to create a culturally inclusive 'im/pure' mathematics education that engages, in particular, rural Nepali children in culturally meaningful learning.

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