

A Pedagogy of Conflict and Dialogue for Mathematics Education from a Critical Perspective

RENUKA VITHAL

Devan: Schools that your education mam [] one of my schools that I went to, mam, they used to bring like the cleverest children in the front and the children that wasn't too clever they should just leave them in the back.

Mathematics curricula, here in South Africa and elsewhere, routinely and increasingly require teachers to develop critical thinking in their learners, intended towards broader societal goals of critical citizenship deemed essential for entrenching democracy. However, in the lived world of schooling, such statements are usually taken as educationally – and politically – correct rhetoric not really connected to the real task of teaching and learning mathematics. But what would happen in a mathematics classroom if this goal were taken seriously?

In this article, I pause and reflect back on a research journey travelled from a particular theoretical landscape. It is one which valued and went beyond the advocacy of such ideas to understand what it means in practice to 'become critical'. This was done by creating opportunities for critique when a mathematics classroom itself is constituted as a space for enacting democratic life. I give glimpses (in the short excerpts) of both the critique and the challenges raised by learners during this journey.

It began with student teachers in a university lecture room where we *imagined a hypothetical situation*, and then went to a school mathematics classroom where we took an *actual, existing, current situation* – a grade six mathematics classroom – and *arranged a situation* (see Vithal, 2000b; Skovsmose and Borba, 2000) inspired by our imagined hypothetical situation. For our landscape of theory, we drew from a broad range of ideas in critical mathematics education (e.g. Skovsmose, 1994), ethnomathematics (e.g. Powell and Frankenstein, 1997), concerns about race, gender and class in mathematics education (e.g. Willis, 1996) and South Africa's own people's mathematics (e.g. Julie, 1993).

The recontextualisation of these ideas in practice took the form of project work (Vithal *et al.*, 1997), where five groups of diverse learners in this classroom chose to explore topics such as 'time spent after school' to deal with the problem of too much homework; 'money spent on my education' – the problem of paying school fees; 'a sports survey' – to play more and different sports in school; developing a mathematics newsletter (Vithal, 2000c). [2]

A brief stay with one student teacher in this specially arranged situation, in order to realise what might be called a *social, cultural, political approach to the mathematics curriculum* during a six-week teaching practice period, led to the (co-)production of a wide variety of data. These data

were organised into what is referred to as a *crucial description* – a description that makes it possible for an interested outsider to provide a critique of the theoretical ideas and associated practices that unfold in a classroom, as well as the accompanying analysis (Vithal, 2001).

Five dual-concept themes emerged from an analysis of this description – *democracy and authority* (see Vithal, 1999); *differentiation and equity* (Vithal, 2000a); *freedom and structure*; *mathematics and context*; *actuality and potentiality* (Vithal, 2000c). These were all underpinned by the notion of *complementarity* (Otte, 1994; Vithal, 2000c), allowing the charting of the beginnings of perhaps quite a different theoretical landscape. Practice was given a rather rare chance to speak back to theory in mathematics education.

The search for new ideas in both theory and practice which emerge from this research journey inspires this attempt to put forward a pedagogy for mathematics education, particularly one that integrates a critical perspective. It has yielded two main components in this pedagogy: conflict and dialogue. The principle that both separates and weaves together conflict and dialogue into a pedagogy is once again that of complementarity. The possibility of moving toward a pedagogy (with its components of conflict and dialogue) and the emergence of complementarity arose from the methodology and process of producing a crucial description of a particular mathematics classroom which served as our laboratory for curriculum thinking and development.

It is a pedagogy that recognises the context in which this curriculum laboratory was located, seeking to remember the unique setting of a 'new' democratic South Africa, but one where the pangs of apartheid have not yet subsided and the scars from its ravages are still fresh and visible as they struggle to heal. It is against this frame that I attempt to develop a pedagogy of conflict and dialogue, underpinned by the principle of complementarity, by addressing the following question:

Why are conflict and dialogue necessary (but by no means sufficient) components in a pedagogy that integrates a critical perspective in mathematics education?

Indeed, why theorise a pedagogy in the first place? And why is complementarity an essential principle in a pedagogy of conflict and dialogue?

Challenging the school and teacher: presentation of project ideas, questioning the use of school funds

Siva: Why the toilets are so filthy? No toilet paper. More sporting activities, better lights. Mam nothing is done with the sporting facilities, they pickle it.

Teacher: Would you be able to find out from a plumber or builder how much it would cost to do the toilet facilities up and then maybe put on a list of priorities. The school is 21 years old. Update the facilities and then get quotations. Then tell the school fund committee, we paid so much school fund, we are recommending you upgrade the toilet

Vaneel: The school built the monument up there I think they should have first checked the price before they built it.

1. Pedagogy, theory and practice

There is no doubt that critical pedagogy has developed a considerable literature. However, in mathematics education, writing in critical pedagogy is arguably rather limited and on the margins rather than at the centre in both research and practice. Mathematics educators have been inspired by and borrowed from the general critical education field. For example, Skovsmose (1994) draws on the work of critical theorists in Europe and Frankenstein (1987) underpins her work with that of Freire.

In general, though, even critical pedagogy has not become entrenched in the centre of attitudes and thinking within the mainstream in schools, nor has it been taken up by the large majority of teachers. This is not to discount some excellent efforts at developing democratic schools, as described, for example, by Apple and Beane (1995). Part of the reason may be that expositions of critical pedagogy have failed, in the main, to take account of the actual situation in a way that validates learners', teachers' and schools' struggles. As they try to think, create and work in an arranged situation in which democracy, freedom, equity and context are valued, they struggle with deeply entrenched forms of authority, structure, differentiation and, especially, disciplinary concerns.

Ellsworth's (1989) early caution and critique of 'critical pedagogy' developed from reflections on her university classroom. It is supported by this research in a primary mathematics classroom. Taking a step forward requires reworking critical pedagogy, so that it emanates from and resonates with the lives and experiences of teachers, pupils and schools. It needs to be developed both in opposition to and in co-operation with existing forms and functions of mathematics education.

The term 'pedagogy' is used in a number of different ways, but its ordinary dictionary meaning refers to the practice, principles, art or science of teaching. In this respect, pedagogy seems to contain some element of prescription. This is, however, not the entire meaning that can be drawn from the pedagogy expounded by leading proponents of critical pedagogy such as Freire (1997) in his well known *Pedagogy of the Oppressed* or Giroux (1997) who writes of 'postmodern pedagogy'. Clearly, from such works pedagogy cannot be interpreted solely as a teaching method but rather as a philosophy or theory (Aronowitz, 1993).

Nevertheless, a pedagogy is a pedagogy, and not a theory

or philosophy, precisely because it is meant, at the very least, to make suggestions or offer some guidance for action and reflection in the classroom. What cannot be escaped is that there is some telling about what educators *should do* or *could do* in the name of a critical education. This telling, however, in much of the critical pedagogical literature, does not typically provide detailed descriptions of classrooms. When such authors do do this, they do not try to take the totality of the experiences of classrooms and schools into account, nor the depth of the shifts required. This is a fundamental and difficult problem in critical education and also pertains to critical *teacher* education.

Pedagogy differs from 'theory', a term which also has many meanings, in including more speculation, contemplation and reflection. In their actual use, these notions of pedagogy and theory overlap: pedagogy, however, is explicitly concerned with and attempts to link theory and practice directly. To speak of 'theorising a pedagogy' emphasises not only saying what should or should not happen in classrooms, but also includes theoretical reflections and contextualisation of those reflections in the principles and practices that characterise teaching and learning. Theorising this pedagogy of conflict and dialogue has emerged from the actual happenings of a classroom and connects back to the theoretical landscape that inspired it.

Pedagogies produced in one context are typically taken and applied in various ways in other contexts. People's mathematics, an earlier version of a critical mathematics pedagogy developed in the apartheid South African context, has not been significantly theorised. The most substantive development of a critical mathematics pedagogy has been from outside; therefore an inevitable importation occurs. This makes a 'grounded' approach to developing pedagogy an imperative especially within the framework of a critical pedagogy. Giroux (1997) has pointed to the problem of creating pedagogies disconnected from their contexts, as well as the problem of creating the means for investigating them.

The acts of conception, and construction, and production that characterise texts *about* pedagogy usually have little to do with the contexts in which such texts are applied, and the principles that structure them almost never lend themselves to methods of inquiry that encourage dialogue or debate (pp 87-88)

The study I carried out attempted to address both these problems. The pedagogy developed here arises directly from the context in which that pedagogy may be applied. Detailed crucial descriptions provide a means for developing pedagogy and also serve to open an emerging pedagogy to critique and investigation. Nevertheless, inherent in any attempt to set out a pedagogy is a contradiction that must be recognised. Keeping the connection of a pedagogy to a specific context from which it arises also contains the very weakening of that pedagogy. A pedagogy must, after all, have broader relevance beyond the particularities of any single context if it is to be a useful and powerful pedagogy.

On the one hand, I argue for a pedagogy relevant to the context in which it is to be applied (say, South Africa). On the other, the deep inequalities and differences in contexts

like South Africa also reduce the strength of that pedagogy if it cannot be applied across this diversity. This pedagogy of conflict and dialogue has emerged from a single, thirty-pupil classroom context that is not widespread in South Africa – a former apartheid-designated ‘Indian’ school which now has both ‘Indian’ and ‘African’ learners but predominantly ‘Indian’ teachers

The implications of such a pedagogy for, say, rural schools with very large under-resourced classes where teachers are barely able to cope with the subject matter remain open to speculation. However, that the pedagogy emerges through a detailed description within South Africa represents an improvement on simply importing a pedagogy for at least two reasons: first, this pedagogy emerged from practice, from a real classroom and from real data; second, it emerged from the broad context of education in South Africa

What are sources for developing and critiquing pedagogies? Freire (1997) states in the preface to his revised book:

These pages, which introduce *Pedagogy of the Oppressed*, result from my observations during six years of political exile, observations which have enriched those previously afforded by my educational activities in Brazil. (p. 17)

Freire, it seems, may have trod a path similar to mine here, but there is no way of knowing the specificities of the situations in which his observations were made. For instance, he alludes to the training course participants who “call attention to ‘the dangers of *conscientizacao*’” and then explains it as “a fear of freedom” (p. xx). But who knows how and why such concerns arose or in whom

The general point is, how can a critical pedagogy open itself for critique? One route is by examining practices in their broad context related to that pedagogy. Crucial descriptions, together with the concept of complementarity, play a fundamental role in allowing us to capture and include the dissenting and negative voices, not so that they can be reconciled in the pedagogy, but so that they can have an equal presence and become part of that pedagogy. In the process of pedagogy construction, typically pedagogies are produced and discussed in terms of ‘what could be’ or ‘what should be’, rather than a situation of ‘what is’.

In this sense, pedagogies project into a future educational setting, enunciating educational principles and practices and providing them with theoretical underpinnings. However, in creating an arranged situation out of which a detailed description arises, it is possible to develop a pedagogy, to make suggestions for and to project toward ‘what is not yet’. Crucial descriptions of arranged situations enable a more grounded critique to be made and reflections to be advocated for particular pedagogies. This too, however, is not without its difficulties.

Descriptions of practices associated with particular pedagogies are important in order that pedagogies do not become prescriptions for practice. Literature expounding critical pedagogy, such as Freire’s *Pedagogy of the Oppressed* which was banned in South Africa during the apartheid era, makes a sharp contrast with ‘fundamental pedagogics’ – apartheid’s own pedagogy, with many ideas diametrically

opposed to those espoused in Freire’s pedagogy. The vast majority of teachers in South African schools today were exposed to some or other form of a strongly prescriptive, autocratic and hierarchical fundamental pedagogics (see Naidoo, 1999).

This prescriptive character remains in the notion of pedagogy in South Africa, even as we move toward a curriculum that seeks to embed a critical perspective. Descriptions of practice are therefore important for a pedagogy, if it is to move away from offering recipes for teaching. Hence, the notion of theorising a pedagogy is important in the effort to rescue it from its prescriptive connotation for practice. It is this problem of prescribing for practice in critical pedagogy that Freire recognises when he states:

That is exactly why I always say that the only way anyone has of applying in their situation any of the propositions I have made is precisely by redoing what I have done, that is, by not following me. In order to follow me it is essential not to follow me! (quoted in Shor, 1993, p. 35)

Freire’s work has been hailed as important and taken up in many contexts similar to those in which it was developed, particularly in educational settings in which learners are in some way considered disadvantaged (see, for example, Frankenstein, 1987). In fact, this is where a critical pedagogy has been most strongly advocated. But what is its relevance more broadly, including contexts of those considered advantaged or privileged found in all societies, especially in deeply divided and differentiated societies. A strong critical pedagogy must surely be one that can be interpreted for the full range of diverse learners and in the broad range of educational settings that are found in all countries.

But the idea of theorising a critical pedagogy, which could have wide applicability, is not unproblematic. A contradiction is inevitable because a critical pedagogy cannot be prescriptive. This creates a particular difficulty that militates against its inclusion in national curricula: there is no set of methods that can be followed. Further, teachers cannot be forced to engage in a critical pedagogy in their practice any more than pupils can be forced to become critical. A critical pedagogy, by its nature, includes and is based on reflections of all kinds, as theoretical ideas are interpreted and recontextualised into different settings of practice.

So how are teachers to gain the means for working with a critical pedagogy in their classrooms? Some soft guidelines and ideas for experimentation are required even in a critical pedagogy, especially to make a start. Then, immediately, theorising becomes important if the guidelines are not to become prescriptions for all teachers and turned into dogma. We cannot escape this difficulty. A critical pedagogy cannot tell teachers what they must do. Yet some level of prescription is needed if the pedagogy is to be realised, especially if a critical pedagogy is to become a ‘mainstream’ pedagogy.

In fact, the need for some guidelines was a main recommendation made by the student teachers in their final reflections, having ‘tried out’ project work in schools. This seems to suggest that a critical pedagogy must offer some means by which teachers can take hold of the ideas and work

with them, or run the risk of forever remaining in the realm of theory in hypothetical, imagined situations. It must simultaneously build in the means and the imperative to reflect and theorise. Providing crucial descriptions of practices that require reflection and which make possible a critique of them offers one such opportunity.

Having focused on the notion of pedagogy, I turn my attention to each of the components of conflict and dialogue, before capturing the complexity of complementarity. Complementarity is the pivot explaining the relation between conflict and dialogue as they emerge from the dual concept themes which comprise the analysis and theoretical deliberations. The question is: why conflict, and why dialogue, and what is their complementarity in a critical mathematics pedagogy?

Challenging each other: Who speaks for whom? Group leader's domination in final presentation questioned

Niren: You have been doing most of the talking
Are you the group leader?

Devan: Ya

Niren: So why don't you let everybody else like talk? [...] because all they had to say was like lunch [...] and something like that [...] but you were doing like [...] most of the [...] most of the talking. Like you were saying like [...] Harry come [...] he came from KwaMashu or something, he could've said that.

2. Conflict in a mathematics pedagogy

The concept of conflict does not appear in an explicit or overt form in the thematic analysis. Yet its presence could be felt throughout at a number of different levels inside and outside the classroom, and in different domains between teachers and pupils, among the pupils themselves and among the teachers. The arranged situation is always full of conflicts carried from and between the actual and imagined situation.

Conflict, as a concept, is certainly found in the theoretical landscape and it seems also to belong to the hypothetical situation. In the data, student teachers showed concern about the kinds of conflicts that could emerge and how they, as teachers, might deal with them in attempting to realise a social, cultural, political approach to the mathematics curriculum. Conflict cannot be escaped because it is inherent in current situations, especially in South Africa.

A basic assumption that Skovsmose (1994) makes in building a philosophy of critical mathematics education is that "society is fraught with conflicts and crises" (p. 12). Here, it is possible to refer to overt conflicts such as those of apartheid and also to the covert conflicts that continue to simmer beneath the surface. If such an assumption of the existence of conflicts is accepted, then since schools are part of society, and pupils and teachers are members of that society, it may be extrapolated that schools and classrooms are fraught with crises and conflicts. Most of the time,

these conflicts and crises are suppressed by the nature of schooling, and especially in the mathematics classroom, by strong structures, authority and differentiation. But they do erupt, among pupils, and between pupils and teachers, and even between schools and other parts of society, such as those who govern schools.

In South Africa, this can be seen quite literally when conflicts in schools get expressed violently: for instance, in tensions that have burst open with violence between pupils of different race groups in school. This contrasts sharply with comments from teachers and principals of schools who continually claim to have no racial or other conflicts. Teacher strikes are also expressions of conflict, but in more controlled ways. Both covert and overt conflicts exist in actual situations and are imported from the actual situation into any arranged situation that may be created. This makes it imperative for a critical pedagogy to include and engage the notion of conflicts.

Both people's mathematics and much of the critical mathematics education literature presuppose a relative homogeneity in the classroom. Conflicts and contradictions remain submerged and are not adequately theorised as constitutive of the mathematics classroom itself as the focus of analysis. Inadequate attention has been paid to the conflicts found with respect to the very lives of teachers and pupils that get expressed in various ways within the classroom, both at the theoretical and practical level.

This imperative becomes stronger as classrooms, and certainly the one in this study, are increasingly characterised by diversity. Conflict has to be given an essential and central role in a pedagogy, particularly one that attempts to link social, cultural and political issues with the teaching and learning of mathematics.

Despite the presence of all kinds of conflicts, by and large there are no programmes in schools which anticipate and acknowledge that conflicts not only exist but are also carried into and play themselves out in schools and classrooms, both explicitly and beneath the surface. Teachers who are themselves implicated in the conflict are not equipped to handle these at a personal or educational level.

Moreover, the new curriculum framework and discussions in South Africa have not prioritised or acknowledged this in any deliberate way. Several of the outcomes specified in the new curriculum implore teachers to take a critical approach, which potentially could result in conflicts in the classroom. But the documents have not recognised what any attempt to realise such a curriculum means in the reality of classrooms and therefore remain at the level of rhetoric. Conflicts exist in all societies, but in South Africa, their nature and form is different given our apartheid history of separation. They are intense and deeply rooted at all levels, from personal to societal levels. This makes any suggestion to bring them into a classroom, and especially into a primary classroom, a risky one.

No doubt one reason for prioritising conflict in a pedagogy in South Africa is that the context within which an attempt is made to realise such an approach is conflict-laden. But a central reason for giving centre stage to conflict in a pedagogy is that a social, cultural and political approach to a mathematics curriculum (one that attempts to integrate a

critical perspective) invites conflict into the classroom. Social, cultural, political and other conflicts arise and manifest themselves because of the deliberate attempt to seek a connection between mathematics, its teaching and learning, and a conflict-laden society

The conflicts between authority and democracy, structure and freedom, mathematics and context, differentiation and equity capture the wide range of conflicts played out in a multiplicity of arenas in the classroom – in the projects the learners undertook, in group work, in the role of teachers, in different relationships, in backgrounds, in mathematics and its conceptions, relevance and relation to reality. Conflicts emerged and some were embraced but many remained unexplored and hidden. Any critical pedagogy must recognise conflicts as an essential component in its formulation and provide the means both in practice and in principle for engaging them

Within this realisation of a social, cultural, political approach to the curriculum, the projects provided entry into many and varied conflicts. Each of the projects could be considered to contain critical situations for the pupils, for instance when they investigated how much their education costs and questioned the use of school fees and the sports facilities. These critical situations opened numerous points of conflict. ‘Conflict’ here must be rescued from its pejorative or negative connotation. As Sumaiya, the student teacher, pointed out, “*conflict is good though, conflict is not bad*”.

In fact, conflict may be considered essential for the development and practice of a critical citizenship in a classroom. Once conflict is overtly invited into a classroom, the notion of critique follows. But critique cannot be directed into some areas and not others, which means anything and everything can be criticised. Learning how to critique becomes extremely important. But this learning has to be broadened quite considerably to include a range of issues and concerns that constitute a mathematics classroom. For instance, criticising mathematics and its use has to be integrated with criticising working relationships and what it means to be fair and considerate of each other both inside and outside the classroom

The implication for teachers is that they would have to value and be committed to such a critical discourse, but also have the necessary knowledge, skills and understanding to initiate and develop such a classroom discourse (see Cherryholmes, 1991) that goes beyond competence in pedagogical and mathematical knowledge. Further, the characteristics of such a discourse must be communicated to pupils who need to develop the necessary understanding, attitude and skills to engage with it. They must also know the purposes, so that intentions of learning are shared

Conflicts arose in multiple settings in the classroom during project work, but they also occurred at different distances to the pupils’ lives. Conflicts at the personal level are different from conflicts at a societal level. It is possible to think of zooming in to conflicts at a micro-personal level, as an individual experiences them. And then gradually zoom out to see conflicts in the small groups, between groups, between the teacher and the class, the class and the school, until a wide-angled lens allows a look at conflicts at

the societal level. At each point, some things stay in focus and others are out of focus and range. But these all coexist and are related to each other

Participants in these critical situations worked through multi-layered conflicts inherent in the themes – in learning to live out components of a democratic life in a deeply unjust world, as well as in learning about the multi-faceted nature of mathematics and its relationship to the context of their world. The point is not about resolving conflicts, but about understanding their nature and learning how to act toward them. This means teachers and pupils becoming comfortable with opening, discussing and dealing with conflicts

This implies teaching-learning situations in which conflicts are not only considered a normal and natural part of the environment, but essential for learning that integrates a critical perspective. In this situation, conflict and critique live in a symbiotic relationship. Meaningful critique of any dimension of society (or schools) – social, political, cultural, economic – requires situations of conflict and situations which make substantial critique possible, which help us to deal with conflicts and crises.

All conflicts that emerge do not have the same status and therefore their engagement in the classroom varies. A conflict in mathematical knowing is often given priority over a conflict in reflective knowing by teachers (Skovsmose, 1994). A conflict in aspects of graphical representations may be considered more urgent and important than a conflict about the implications of graphical representations for a social problem in a mathematics classroom. Moreover, a conflict in mathematical knowing is handled differently from one in reflective knowing

The margin for dialogue in mathematical knowing is much smaller in primary classrooms than for reflective knowing, since the teacher’s assertion of authoritative knowledge is greater. Teachers and pupils know that the conflicts set up for debate in mathematical knowing are different from those in reflective knowing, which are considered to be more open. In mathematical knowing, the teacher is expected to resolve the conflict. She should know the answer as part of her didactical authority and obligations. Reflective knowing is different, because it could be a matter of opinion and the pupils may have knowledge the teacher does not.

What is the extent of the opportunities that school mathematics can actually offer for challenging the ideology of certainty in mathematics, so prevalent in classrooms (see Borba and Skovsmose, 1997)? The idea of using conflicts in mathematics teaching and learning is well known, for example, in the notion of “cognitive conflicts”. Here, the teacher knows exactly what comprises its resolution and both teachers and pupils generally share the idea that a resolution is always possible. This may not be the case in reflective knowing, when considerations other than mathematics may take precedence in the conflict dialogue.

Teachers do not always get to choose and prioritise the conflict. Learners can find the means by which to raise a conflict for discussion in a class, as was observed. A conflict becomes a crisis when it is forced into a situation of dialogue: for instance, pupils forced the teachers to address the ‘school fund’ conflict and turned it into a crisis. This

crisis took centre position in the critical situations represented in their projects.

Typically, schools in general, and teachers in particular, operate as if there is no conflict, until a crisis emerges – for instance, in some protest action or violent clash. Conflicts are usually forced into a crisis through disruptions. It is in these settings, then, that the teacher could engage crises through dialogue. But this is not the only route for a conflict to become a dialogue. A critical pedagogy seeks actively and deliberately to bring conflict into dialogue. This may be essential in the current South African context, so that conflicts are not left to simmer and explode in chaotic and destructive ways, but are channelled into openness through a careful but systematic process that can allow for compassion and understanding of the complexity of the conflict.

The current South African educational situation may be considered to be in perpetual crisis containing many opportunities for potential critical discourses to be engaged in mathematics classrooms. Teacher strikes, and protest action by pupils and parents arising from the difficulties in redistributing human and physical educational resources across schools, offer the opportunity to create dialogue around conflicts and crises which connect schools and the broader society in very direct ways.

The potential for a pedagogy of conflict and dialogue is enormous. The projects have indeed demonstrated this both in actuality and in potentiality. However, the closeness of conflict can also make dialogue difficult: for example, the difficulty of a teacher who belongs to a union, goes on strike and is questioned about it by pupils who also suffer the direct consequences of the teacher's strike and who may disagree with the teacher's actions. Yet, in this very situation lies the possibility for an authentic dialogue based on a conflict involving the lives of both teachers and pupils.

At a societal level, much of the disruption and disadvantage continues to accrue to 'African' and 'Indian' schools, while 'White' schools remain relatively free of disruption. A pedagogy of conflict and dialogue is not only a pedagogy for the disadvantaged and under-privileged, although it has an important role there, as has been advanced in most discussions of critical pedagogies. It may be argued that a pedagogy of conflict and dialogue is as necessary in 'White' schools precisely because they are more privileged.

Pupils in advantaged schools, especially those from privileged backgrounds, may be considered disadvantaged because of their lack of knowledge and skill in facing the inequalities and injustices of South African society. More importantly, they equally need to understand how they have come to be advantaged and to act in ways that can contribute to a more equitable and just society. Further, advantaged schools are not free of the inequalities of society, since they have pupils from disadvantaged communities. But these are often masked through the forms of authority and structures employed, and the ways of handling differentiation through which conflict is actively suppressed. It is likely that a pedagogy of conflict and dialogue would be resisted more vigorously in such schools.

Advantage and disadvantage are relative: schools and pupils can be advantaged in some respects and disadvantaged in others. The school referred to in this article may be

considered disadvantaged in relation to 'White' schools, but is better positioned than most rural schools. A pedagogy of conflict and dialogue requires not only knowledge and skill in managing conflicts for learning, but requires sensitivity, care and compassion on the part of the teacher and a strong attitude about fairness and justice. This also has to be developed in pupils if conflicts are not to be damaging. What needs to be recognised is that conflicts have both a cognitive or intellectual component, as well as an affective or emotional one.

Since conflicts do not exist in any hierarchical order, but interact in a chaotic way, the attempt to engage in a dialogue to deal with any one conflict or crisis can have unforeseen consequences for some other conflict and crisis (Skovsmose 1994). This makes it very problematic to consider notions of emancipation or empowerment. Devan, a failing mathematics learner in the actual situation, who succeeded dramatically in the arranged project work setting, may be considered as having been empowered, but was also left feeling disempowered as he threatened the classroom hierarchy of competence. Taking any action in situations of conflict always means running a risk, because acting in a particular way cannot allow predictions about what impact it may have on other aspects, which may or may not be in the field of vision.

Emancipation and empowerment are goals of a critical pedagogy that belong in the realm of theory and hypothetical ideals. Indeed, Ellsworth (1989) argues for the need to redefine critical pedagogy because notions such as empowerment and emancipation, central to such pedagogy, are unattainable "utopian moments". Yet they are important and have a role to play. Their importance lies in inspiring a particular arranged situation, in giving a rationale and justification for conflict and dialogue to become practices in the reality of classrooms, and in reforming practice and theory. A pedagogy of conflict and dialogue, which brings hope and possibilities into a mathematics classroom, may be more appropriate than a pedagogy of emancipation.

The arranged situation embodies the tension between the imagined and actual situation, hence one of its main constitutive principles is the idea of opposition or conflict. The dual-concept themes that emerged from an analysis of the arranged situation are underpinned by a complementarity, described as containing pairs of concepts that are both antagonistic and co-operative. The antagonism or opposition make conflict one of the essential features of complementarity. Even as they co-exist, the concept of freedom is in conflict with structure, authority is in conflict with democracy, and mathematics conflicts with context, as does differentiation with equity.

The arranged situation embeds these conflicts, which arose from attempting to change a current situation by means of ideas from a particular hypothetical situation envisioned. Not only are conflicts imported from the actual situation; in becoming an arranged situation, the actual situation creates its own conflicts. The fundamentally different natures of the actual and the imagined situations mean that conflict will always be a feature of any arranged situation. A pedagogy of conflict and dialogue inhabits the space between 'what is' and 'what is not yet' or 'what could be'.

Conflict arises from that which exists and that which we seek to have existing. In this small space, there are many significant and critical conflicts operating which make a pedagogy of conflict and dialogue important for mathematics classrooms.

The exemplary potential of engaging conflicts at a classroom level for the societal level is considerable. Knowledge, skills, values and attitudes generated through this engagement in a mathematics classroom must surely carry into other settings and at other levels. It is not possible to be sure if these are negative or positive, because of being unable to control what is actually learnt in any situation by any pupil.

Challenging project work: the difficulty connecting the newsletter with mathematics

Vasentha wrote in her diary:

All the groups have wonderful ideas and they are also very interesting. But could you please tell me how this project is related to maths? I just can't seem to figure out how.

3. Dialogue in a mathematics pedagogy

Dialogue and negotiation are well known in mathematics education as progressive pedagogical practices. Indeed, in a conflict-laden "new" South Africa, they are well developed and well established as a means for dealing with conflicts and crises. There is, after all, what is referred to as a 'negotiated settlement' in the aftermath of the crises of apartheid, which was secured through dialogue. But this achievement has remained largely at a political macro-level. The new intended national curricula have all been arrived at through negotiation, with many competing and conflicting interests from different stakeholders in education.

However, within schools themselves a deeply authoritarian and undemocratic culture continues to dominate and this permeates the teaching and learning settings within classrooms. The spirit and ethos of the new South Africa has not, in the main, entered the vast majority of schools and classrooms, and most certainly not the mathematics classroom. Traditional teacher-dominated lessons, especially in mathematics, continue across the broad spectrum of schools, in which pupils usually speak only when spoken to and then no more than a sentence (see Naidoo, 1999), and corporal punishment is still widespread even though banned.

In putting forward a pedagogy that privileges dialogue, a very different way of being in schools and classrooms is suggested for both teachers and pupils, requiring a fundamental shift in the nature of their interaction and communication in mathematics classrooms. It is a pedagogy that has potential and hope precisely because it is not contrary to the societal changes supported in current national curricula reforms. If conflicts are considered necessary in a critical mathematics pedagogy, then dialogue and negotiation may be considered essential didactical tools.

I refer to *dialogue* rather than *negotiation* in a pedagogy of conflict and dialogue for two reasons. The first is because negotiation has come to have a meaning related to resolution in a conflict, while dialogue seems to be a more open concept which is closer to the meaning intended here. The

second is because the notion of dialogue has been employed and developed by (among others) both Mellin-Olsen (1993) and Skovsmose (1994) within the framework of a critical mathematics pedagogy that considers social, cultural and political dimensions.

But it is not a simple, unproblematic concept and must be reworked to give it meaning within the diversity of schools and classrooms. Dialogue is, as Ellsworth (1989) says, "a fundamental imperative of critical pedagogy" (p. 314). Found in the writings of almost all critical educators, it typically:

requires and assumes a classroom of participants unified on the side of the subordinated against the subordinators, sharing and trusting in an "us-ness" against "them-ness". This formula fails to confront dynamics of subordination present among classroom participants and within classroom participants in the form of multiple and contradictory subject positions. (p. 315)

This holds for much of the literature that in various ways explores a critical perspective in mathematics education. It was observed, as Ellsworth did, in the classroom from which the crucial description emerged that it was not always a safe place for all pupils, nor did democratic dialogue dominate. However, in a pedagogy of conflict and dialogue, dialogue can be rescued from what seems to be its rather naïve, idealistic conceptions and given a broader and deeper meaning that captures the contradictions and co-operations of complementarity which manifested themselves in the themes within the arranged situation.

A social, cultural, political approach which values critique invites conflict. To deal with conflict, dialogue is essential. The dual-concept themes, and their complementarity, embedded in this conflict, give dialogue this central place in a critical pedagogy. The contradictions in the themes, such as between authority and democracy, are brought into co-operation through dialogue. Dialogue, in the arranged situation, had to take account of the nature of authority even as the struggle to develop more democratic forms of interacting was engaged in.

The pupils questioned the teachers' authority precisely because dialogue was allowed and valued, even as that authority also served to silence them. Dialogue has to take account of the structures of classrooms and schooling as freedoms are offered. Just as classroom dialogue was on the verge of addressing some critical issue of racism or equity, the bell sounded for the lesson to end and the moment seemed lost. The conflict between a focus on the graphs drawn and the reality that they represented moved from one to the other through dialogue.

The shift from one perspective to the other, given by the vast differences between the progressive imagined situation and the traditional conventional actual situations, positions dialogue centrally in this pedagogy. Conflicts, which are assumed by and inherent to the arranged situation are forced into the open through dialogue. Then they become crises and make dialogue a necessity. The pupils question and engage in uncomfortable dialogue with one another and their teachers.

Even as there is silencing and marginalising (Secada,

1995; Vithal, 2000a), there is a recognition that they have a voice, and that it can be heard, because of dialogue. Here, dialogue is not only about speaking, because pupils also made their voice heard through their diary writing. Dialogue is about having voice and that voice can have different representations. But voice was also present in silences. Some silences were heard and felt because of the absence of voice, even while it must be acknowledged some were not.

The appropriateness but also the contradictory nature of dialogue in a critical mathematics pedagogy can be seen in Mellin-Olsen's (1993) elaboration of dialogue as a didactical tool. The nature of dialogue, as explained by Mellin-Olsen, is appropriate for the kind of conflict-laden teaching and learning situation here, because he also implicitly deals with conflict:

The focus of the dialogue is not the persons who speak. It is the theme: The natural genesis of the discussion should lie in the efforts of the participants to clarify something that extends beyond their respective 'I's' (p. 247)

For Mellin-Olsen, a dialogue must function for the participants as an epistemological tool, one in which the dialogue provides not only a better understanding of each other, but one *with* each other. The disagreement or conflict must play itself out in a way that does not destroy the dialogue.

Such an understanding of dialogue implies not a search for consensus, not for compromises, but a search for deeper insight with the partners of a dialogue [...]. Both partners are subjects of this activity, in the way that each of them interacts with the other, and in this way reflect and act on the ideas interchanged through the dialogue. The mutual friendliness and tact of the participants has to be notified. (p. 247)

If conflicts are opened in classrooms, the means for engaging them for communication and interaction are equally important parts of learning. So learning about the tool, about dialogue, is as important as learning about the content, about conflict. Sumaiya pointed out, after some particularly harsh criticism from the class toward one learner's handling of the project presentation, that she had to teach them how to criticise.

The teacher is in this process developing a "confrontation praxis" (Mellin-Olsen, 1993) among her pupils, in which the development of ideas in confrontation with each other becomes a legitimate activity. Speaking in ways that respect each other's point of view in a dialogue is especially important when the confrontation begins from an 'I' position. However, this pedagogy of conflict and dialogue needs also to consider a 'we' position in the dialogue. Dialogues are not only about person-to-person interactions. They include person-to-group and group-to-group dialogue, where the composition of the groups continually shifts depending on the conflict under consideration.

Recognising this is important in taking account of how different 'affinity groups' (Ellsworth, 1989) form and work together across individual differences. The teachers also shift positions as individuals and as members of groups, siding with particular groups in a particular dialogue and opposing them in others. This pedagogy of conflict and dialogue cannot assume that all participants *want* to engage

in dialogue as the notions of silence and silencing indicate. A strong concern with dialogue, especially in settings in which conflicts are deep, structurally rooted and painful, is that pupils may resist or refrain from expressing conflicts. It is here that the possibility exists that dialogue could suppress conflict. Conflicts may be suppressed because of the strong emphasis on reconciliation and consensus-oriented dialogue within broader South African society. This reduces the possibility for raising issues that are likely to lead to conflict, such as racism, which are difficult to address and change in a racially diverse classroom.

In all these instances, as Mellin-Olsen (1993) argues, dialogue itself contains two opposing but necessary positions. Dialogue as a tool for gaining insight and knowledge views dialogue as a confrontation about ideas and understandings.

The power of the tool lies in its method of confrontation which is based on the idea that consensus is not a goal (p. 245).

The paradox is that to engage in such a dialogue also requires the participants to agree and co-operate with each other; that is:

confrontation and disagreement [...] have to be developed in a context of agreement and co-operation. (p. 256)

The implication is that teachers have to manage a balance in this complexity and contradiction at various levels and in different classroom circumstances. Dialogue is an essential didactical practice for classroom situations that provide opportunities for learning through conflict. The complexity of the task for both teachers and pupils is captured by complementarity, in that the teacher must create a learning environment in which pupils continue in dialogue even as they experience some strife or other. Dialogue is a method of both confrontation and co-operation, a tool for exploration of both harmony and discord.

How dialogue as a tool is handled is not disconnected from what that dialogue is about. The content of a dialogue needs to be considered in the process of dialogue-making. Different conflicts in content matters are likely to lead to different kinds of dialogue. The dialogue related to the newsletter project was different in significant ways from the dialogue on school funds. When dialogue is based on conflict in topics closer to pupils' own lives, pupils seek to control what they want revealed through dialogue to the group or to the teacher.

Pupils also make decisions about how much they want to invest in any particular dialogue. Some pupils set up conflicts and asked questions in a number of presentations, while others remained silent throughout. While some pupils will take to a conflict-laden dialogue, others may resist such an engagement. This means that both teachers and pupils need to develop the knowledge and skill to engage in a dialogue and to value it as a didactical practice, especially within a pedagogy of conflict and dialogue, and must share the purposes for critical dialogue in a classroom.

When pupils are confronted with different forms of knowledge or knowing, it is through dialogue that pupils can come to an understanding of the complementarity of those

forms of knowledge. The “homogeneity of knowledge”, which is the assumption that “it is possible to integrate all sorts of knowledge into one unified system” (p. 196) has been rejected in a critical mathematics education by Skovsmose (1994). Instead, he establishes dialogue as an epistemic concept in which:

contradictory knowledge claims can rightly be made with the consequence that knowledge conflict becomes a reality. (p. 205)

In setting up knowing (rather than knowledge) as an open and explosive concept, the possibility for knowledge conflicts is created. Conflicts in knowing, according to Skovsmose, cannot be ignored; they must be settled, but they cannot be resolved empirically by collecting more information or doing more calculations. They have to be dealt with in terms of negotiation, in which critique and reflection are needed. In this notion of dialogue, critique and reflection are not only possible but also essential for epistemic development in a critical mathematics education.

However, if knowing is to remain an open and explosive concept, dialogue offers only a temporary epistemic adjournment: dialogue, in a pedagogy of conflict and dialogue, not only does not seek to arrive at a consensus – it contains a perpetual incompleteness. Crises and conflicts are chaotic and any action on some has unforeseen consequences on others. We can never be certain of our understanding and have constantly to strive toward further understanding and action. The means for doing so lie in the effective and efficient use of dialogue.

If conflicts may be set up in different ways, in different forms of knowing, it follows then to ask whether dialogue will also take different forms. What or who shapes the differences in dialogue in mathematics classrooms? How does a dialogue in mathematical knowing differ from one in reflective knowing? A dialogue may need to manage ‘didactical authority’ in mathematical knowing, but also an ‘emancipatory authority’ (Giroux, 1997) in reflective knowing, which may produce a different dialogue (Vithal, 1999).

What must be addressed are power relationships inherent in dialogues. In what sense can dialogues be fair or secure equity or equality in participation? Who controls dialogue in a classroom? How a dialogue is initiated and managed must take into account the inherently unequal nature of the relationship between teachers and pupils. This power relation plays itself out even in a dialogue among pupils themselves. In multilingual settings, dialogue has to also take account of the hegemony of the dominant language in which communication takes place. Facility with the dominant language of English in the classroom facilitated the expression of conflict and its engagement through dialogue differently for English first- and second-language learners.

Dialogue as tool is separate from the conflicts it mediates, but it is connected to the content of different conflicts. It is a question not only of what conflict is under discussion but of whose conflict it is – the teacher’s, the pupils’, which pupils? Dialogue has to cope with domination and resistance in a classroom, and hence the tool itself takes different forms in different spaces and with different actors. Mellin-Olsen (1987) suggests that it is the notion of challenge that offers

the possibility for reducing or eliminating domination and similarly Skovsmose (1994) has suggested that challenging questions can force shifts in dialogues between different forms of knowing. Challenge or challenging questions, whether they come from pupils or teachers, can make a conflict or contradiction visible and bring it into dialogue. But its fate cannot be predetermined.

Conflicts in knowing and the corresponding didactical tool of dialogue are also important because they are generative of ideas in a critical mathematics pedagogy.

From knowledge conflict, we may hope to develop new concepts and to be able to reflect upon knowledge already held. If knowledge conflict is to enter into a dynamic process, its critical and dialogical nature has to be emphasised [...] a dialogical epistemology becomes a part of the epistemic framework for critical education. (Skovsmose, 1994, pp. 205-206)

Conflicts in knowing make visible incompatible or inconsistencies in conceptual frameworks. Unless conflicts in knowing find expression in a classroom, they cannot be put into dialogue. Through dialogue about such conflicts, changes in concepts and understandings arise, as well as new concepts and understandings. All participants – teachers, pupils and researchers – are conceived of as epistemic subjects in development. It is this aspect of generativity of new understandings and insights for all participants in a dialogue that serves to flatten the hierarchy and contributes to more equitable power relations in a classroom. Dialogues in their multiple forms open as much room for teachers to come to know something new as they do for pupils and with them comes the possibility for change. But this potential varies from conflict to conflict in the different forms of knowing.

A conflict is brought into the awareness of all participants in the arranged situation through dialogue. But dialogue is not limited to awareness and reflection. Freire (1997) explains dialogue as containing two dimensions: *reflection* and *action*. He argues for an essential and radical interaction between these two dimensions, because if one is sacrificed, the other suffers. When dialogue is deprived of its dimension of action, it becomes empty, reduced to idle chatter. Yet:

if action is emphasised exclusively, to the detriment of reflection, the word is converted into activism. (p. 69)

Both these dimensions are needed in dialogue and must be engaged in a critical pedagogy. Dialogue is implicit to both action and reflection. When pupils are engaged in action – for instance, asking the school principal questions in an interview – they are in dialogue, as they continue to reflect about possible responses. When they come together in the groups or in spaces between the actions, they make reflections in dialogue about what are the implications of what the principal said or did for their project. This points to different kinds of dialogue: ‘dialogue in reflection’ is different in form, nature, content and goals from ‘dialogue in action’.

For Mellin-Olsen, the notion of ‘Activity’ as it relates to the activity of pupils is a central idea in a critical or political mathematics pedagogy, and it is also emphasised by Skovsmose in the notion of ‘learning as action’. The absence of the dimension of reflection or action also needs to be

considered from the perspective of resisting or refusing to engage in action and/or reflection. Reflections on the consequences of actions may lead to the action of not acting; having acted in a particular way may make reflections too painful. This points to the fragility of dialogue: dialogue through its dimensions of action and reflection also contains its own destruction.

Dialogue belongs in a politicised mathematics classroom. Noddings (1993) argues that this:

promote[s] both mathematical achievement and effective participation in sociopolitical life [. . .] To reject the study of mathematics as a free and well informed decision is the choice of a responsible citizen; to plod through it docilely is a slavish response, and to drop out without reflective consideration is to lose an opportunity to both learn mathematics and learn about oneself. In a politicised classroom, students become citizens who have some control over their academic lives. This means promoting dialogue within mathematics lessons and about mathematics as a potential avenue of self-affirmation. (p. 156)

These remarks capture the multiple goals and tensions of a social, cultural, political approach to a mathematics curriculum, which are made manifest in the dual concepts of the themes. Complementarity allows us to see how these are kept in antagonistic confrontation through conflict, but also to see how they are held together co-operatively through dialogue. These conflicts cannot be resolved, but they can live in dialogue with each other. Freedom may be in opposition to structure, authority may oppose democracy, just as differentiation may contradict equity. But the one cannot exist without the other in the mathematics classroom and this is made possible through dialogue.

Here, the key concepts in each theme are in conversation with each other, so as to realise the arranged situation of the classroom. This dialogue takes place across the actual and hypothetical situations, within the arranged situation. It is also a dialogue between the past and the future, between how mathematics classrooms are and how they could be – and between actuality and potentiality. These connections and tensions are enacted through dialogue among all the participants in the arranged situation – the pupils, teacher, student teachers and myself as researcher/teacher educator.

Challenging mathematical representations: Thandeka and Devan point out the problem with the single graph drawn by Education group 5

Thandeka: They didn't find out more information. Could have found out what the track suits cost, tie cost, shirt, shoes [. . .] See Patricia spends R300 for school wear, I spend R400 [. . .] They didn't show the differences of prices in the one graph, they didn't tell the children why they are using one graph. They weren't honest.

Devan: What I don't understand, they said how much does their education cost, how can you have one calculation?

4. Complementarity in a pedagogy of conflict and dialogue

Complementarity emerged as an important and pivotal idea in this arranged situation and preserved its presence and identity in the crucial descriptions from which it came into existence through the thematic analysis. Complementarity is a rather well-established idea in the philosophy of science and now widely used in a diversity of disciplines. However, it is grounded in this study in general and in this pedagogy in particular, mainly through interpreting Otte's (1994) elaboration. A main example of complementarity explored by Otte involves the notions of tool and object: using these illustratively, he specifies complementarity as constituting two main ideas.

First, objects and tools are woven together: they *presuppose* each other. The one cannot be defined or described without the other. Second, objects and tools are contradictory to each other: they *oppose* each other. One does not directly show itself in the other. So, for Otte, the idea of complementarity expresses a basic perspective in coming to understand and constitutes an essential condition for knowledge production. It provides a way of speaking about our means for understanding as being insufficient. Taking any one perspective excludes another. This does not mean that the other is not present, but rather that when we experience the one, the other is excluded.

Following Otte, it is possible to consider that within a pedagogy of conflict and dialogue, conflict as object or content exists in complementarity with dialogue as conceptual tool. Complementarity may then also express a basic perspective for understanding mathematics classrooms and an essential condition for knowledge production within them, particularly those in which a social, cultural, political approach is being attempted. This means that complementarity has a place in producing knowledge about mathematics education theory in general, but especially within the varied and multiple forms of knowing such as mathematical and reflective knowing that are central in a critical mathematics pedagogy.

There are different ways in which to consider complementarity in a pedagogy of conflict and dialogue. If conflict is taken as object and dialogue is taken as tool, then conflict and dialogue are paired in a relation of complementarity. Conflict as object refers to what could comprise the content in this pedagogy, which includes all kinds of knowing and the conflicts within and between them. Complementarity in epistemological knowing is not a new idea: it is well established in mathematical (e.g. Otte, 1990) and in the relation between mathematical and reflective knowing (e.g. Mellin-Olsen, 1993).

Dialogue as epistemic tool suggests a pedagogic means for engaging the content of a pedagogy of conflict and dialogue. Both dialogue and conflict are needed in a critical pedagogy. It is possible to imagine a pedagogy of conflict without dialogue degenerating into anarchy and chaos or dictatorship. Current situations in South African schooling include pupils' expressions of dissatisfaction with the school (its authority, structures and dimensions of differentiation such as racism) expressed through violent means. These are then curbed through enacting stronger forms of autocracy.

rather than democracy in interactions with pupils – and more rules and structure rather than freedoms and choice. Pupils do, in a sense, force schools into a pedagogy of conflict when the conflict between their lives as lived in school come into sharp conflict with their lives outside school. A pedagogy of dialogue is essential to a pedagogy of conflict, especially if democracy, freedom, context and equity are to be valued and respected in schools

It is also possible to imagine a pedagogy of dialogue without engaging conflict reduced to endless rounds of benign, entertaining, interesting safe talk and action. Teachers in more advantaged schools could talk about the inequalities and injustices brought about through apartheid in a pedagogy of dialogue without conflict. Pupils in the presence of this pedagogy could never really come to make connections between the apartheid past and the present, or question or act on the conflicts produced through huge inequalities in living conditions immediately around them – for instance, to raise concerns about why are some pupils living in squatter settlements without their basic needs being met, to know what it means to live in such conditions for a day or to experience what it really means to go to a school that does not have toilets, electricity or water.

A pedagogy of conflict and dialogue therefore means that each of conflict and dialogue presupposes the other in a mathematics curriculum approach that seeks to focus on and connect with social, cultural, historical, economic and political aspects of society. They are separate and each must be developed independently: conflict as content and dialogue as tool. But they are also connected and therefore must be realised in relation to each other in a classroom.

Conflict and dialogue no doubt contradict and oppose each other. Conflicts by their nature are about disagreement and disharmony: they contain intellectual elements but also carry emotions and attitudes. Dialogue is about conversation and communication: it contains the development of rational and reasonable arguments, but also there is the element of respect and of *having* to listen.

It is not difficult to see how conflict and dialogue live in constant tension to each other. When conflicts are too severe, dialogue has a minimised chance to show itself. When dialogue is too strong, conflicts may become submerged. A pedagogy of conflict and dialogue is needed to preserve the authenticity of the conflict and its corresponding dialogue that arises in a social, cultural, political approach to a mathematics curriculum.

Complementarity in a pedagogy of conflict and dialogue lies not only in the concepts of conflict and dialogue themselves, as discussed so far, but also comes from the dual-concept themes that both give rise to and comprise such a pedagogy. Each of the identified themes: structure and freedom, authority and democracy, mathematics and context, differentiation and equity, as well as actuality and potentiality, embed conflict and require dialogue. Each of the concepts in the themes are disconnected through conflict but connected through dialogue.

Complementarity resides in each of the themes, in the antagonism and co-operation of the concepts, in the concept collective of structure, authority, mathematics and differentiation found in the actual situation, and the concept

collective of freedom, democracy, context and equity found in the imagined situation. Complementarity is an essential idea found in the arranged situation. A pedagogy of conflict and dialogue is the means by which that arranged situation is explained and described. It is a pedagogy of ‘what happened’ in actuality, as well as a pedagogy of ‘what is possible’ and ‘what can be’ in potentiality, derived directly from the curriculum laboratory of a mathematics classroom.

The principle of complementarity, which is the foundational concept in a pedagogy of conflict and dialogue, enables talk about what teachers and pupils do in the curriculum laboratory, not in terms of failure and success, but in terms of actualities and potentialities, of constraints and possibilities. Complementarity forces a declaration of the perspective and lens from which one comes to look into a classroom and to understand the nature of these perspectives and lenses as both in opposition and in coalition.

A pedagogy of conflict and dialogue represents the nature of the arranged situation in the five complementarity themes. Structure, authority, mathematics and differentiation (found in the actual situation) refer back to a dominant positivist paradigm, while freedom, democracy, context and equity (which emerged from the hypothetical situation) talk back to a ‘utopian’, idealistic critical paradigm. Complementarity, in its antagonistic or conflictual character together with its co-operative or dialogic nature, becomes a foundational idea in a pedagogy that seeks to remember both the actual and the imagined situation in the arranged situation. The complementarity between reality and hope, between actuality and potentiality, is reflected in a pedagogy of conflict and dialogue. While actuality is characterised by conflict, dialogue is needed to inspire and develop potentiality.

Devan wrote in his diary:

I feel great doing project work and I am finally starting to like maths. Maths is quite interesting now

We are working with our budget and am enjoying it. And for the first time I am feeling important doing something. Everyone needs me in this group and I feel very important. Mostly people used to treat me like nothing but now I feel very happy working like this and I hope to get a good pass in maths.

5. Conclusion

In this article, I have attempted to give substance to a pedagogy of conflict and dialogue for mathematics education appropriate to the educational needs of a developing democracy. It is a pedagogy that arises from the difficult yet exciting current situation in South Africa and through which I seek to make a contribution toward a new curriculum vision for South Africa:

A prosperous, truly united, democratic and internationally competitive country with literate, creative and critical citizens leading productive, self-fulfilled lives in a country free of violence, discrimination and prejudice. (Preface to the Discussion Document Curriculum 2005, Dept. of Education)

This article (and the underlying study) has explored the possibility to take a small step toward this vision by engaging student teachers with ideas emerging within the literature on the social, cultural and political dimensions of mathematics education which integrate a critical perspective. By creating a space in a supportive and collaborative environment for prospective teachers during teaching practice to transform these ideas into practices within a real mathematics classroom, this research begins to give meaning to and shed light on the notion of becoming critical in mathematics education in South Africa

A pedagogy of conflict and dialogue offers a means for realising these broader goals of critical citizenship, democracy, equity and social justice within the very life of a mathematics classroom. Yet even if successful, it would necessitate continuing to ask searching questions: for instance, how would such an approach be sustained if the outcomes are protest actions which invariably involve violence

Nevertheless, becoming critical is not confined to pupils alone. Mathematics educators need to be reflective practitioners in the broad sense and to take an equally critical stance in relation both to mathematics and mathematics education. Within mathematics teacher education (and research), this implies that there is a need to develop a critical attitude, firstly, in relation to practices and theories, and secondly in relation to the disciplines of mathematics and mathematics education, particularly with respect to their roles and functions in society. The implicit imperative entails viewing mathematics and mathematics education from a critical perspective both from within and from the outside. How else can we ever expect pupils to do the same? A self-critical approach is essential in theory, in practice and in research.

To conclude, apply such a self-critique back to this article. Mathematics itself as a discipline is not foregrounded in this elaboration of a pedagogy of conflict and dialogue. This I concede; yet, it is precisely because of the status, power and strongly distinguishable character of mathematics as a discipline in the school curriculum that these tensions in the arranged situation were thrown up in such sharp relief. Further, both aspects of conflicts and dialogue are relatively well developed within mathematics and the mathematics education literature.

My intention has been to consider conflict and dialogue at the boundaries of mathematics and mathematics education, in order to address them at the interface of social, cultural and political aspects of schooling on one hand and the teaching and learning of mathematics on the other. In so doing, the challenge being mounted is that of bringing the boundary into the centre of deliberations within mathematics and mathematics education. A pedagogy of conflict and dialogue makes visible and allows us to become aware of and act on the hidden curriculum of a critical mathematics pedagogy.

Notes

[1] This article is an abridged version of the final chapter of my doctoral dissertation (Vithal, 2000c). An earlier version was presented in the "Social and political aspects of mathematics education" Working Group in Action 12, ICME IX, Japan, July 2000

[2] In the study as a whole, twelve student teachers participated across seven previously racially segregated schools in eight different projects (see Vithal *et al.*, 1997, for their project work descriptions and initial analysis). My doctoral dissertation focuses in depth on the work of one student teacher, Sumaiya Desai. For another detailed project description by another student teacher, see Paras (1998)

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