EVERYONE CAN LEARN MATHEMATICS: ADDRESSING THE FUNDAMENTAL ASSUMPTIONS AND GOALS OF CURRICULUM 2005

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One of the fundamental assumptions of Curriculum 2005 is that all learners can learn mathematics and succeed. This, together with rhetoric about "equity", "redress", "access" and "personal empowerment", is certainly appealing in a country with a legacy of inequality in education. Working in collaboration with the TAP Project in Israel, MALATI has developed a philosophy of and approach to teaching and learning which we believe reflects the basic underlying assumptions and goals of Curriculum 2005. This requires a shift in thinking about the notion of "equity" and changes in classroom and assessment practices. This paper describes the MALATI philosophy and reports on the process of implementation of the approach by two teachers in a MALATI project school. Successes achieved as well as obstacles to implementation as perceived by the teachers are discussed.

Introduction

National policy documents for Curriculum 2005 contain technical guidelines on interpreting the outcomes, designing learning programmes, planning assessment etc., and much attention is currently being paid to the implementation of these guidelines in schools. While acknowledging the necessity for and merit of these initiatives, we feel there is a great need to focus on the underlying assumptions and goals of Curriculum 2005 and the possibilities for the realisation of these ideals in the mathematics classroom. For example, one of the basic assumptions of this curriculum is that all learners can learn mathematics and succeed. "Equity", "access", "redress" and "personal empowerment" are highlighted as important goals of the curriculum (Department of Education, 1996, 1997b). The Department of Education (1998) describes outcomes-based education (OBE), a fundamental principal behind Curriculum 2005, as

> *…a learner-centred, result-oriented approach to education and training that builds on the notion that all learners need to and can achieve their full potential, but this may not happen in the same way or within the same period.*

In view of the history and legacy of inequality education in South Africa and recent reports of poor performance by South African learners in the Third International Mathematics and Science Study (TIMMS), it is imperative for the sake of the individual, society and the country that the goals of Curriculum 2005 be achieved and that more learners have the opportunity to study mathematics for a longer period than has been the case in the past.

Official documentation for Curriculum 2005 and literature on OBE provide suggestions on how the broader ideals can be achieved. This demands shifts in thinking about the notion of time, the role of the teacher, classroom organisation and the use of assessment. In this paper we will very broadly discuss the issue of time, describe the view of the Mathematics Learning and Teaching

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Initiative (MALATI) on "equity" and assessment, and then focus on the efforts of two teachers to implement the MALATI approach in their classrooms.

Time

Official documentation for Curriculum 2005 states that "time no longer controls the learning process". Rather, teachers are required to use a variety of teaching methods and assessment tools to assist each learner to develop and succeed at his/her own pace (Department of Education, 1997b, 1998). Referring to OBE, Schwartz and Cavener (1994) describe how the teacher provides a process of "expanded opportunity and support for learning success":

> *Teachers use a variety of teaching methods and allow each student enough time to ensure that the curriculum is implemented and the outcomes are achieved. Students have multiple opportunities to master segments of learning or receive remediation while other students receive enrichment assignments…"*[1]

This is radically different from the traditional approach to time in which the school year is divided up according to the requirements of the prescribed syllabus. A teacher using this approach might, for example, decide to spend three weeks on the study of integers. She then teaches the whole class the same work at the same time. After three weeks she moves on to a new topic, otherwise she will not "cover the syllabus". In our view such an approach promotes inequity because some learners in the class might not, at this stage, have gained the necessary understanding of integers and will thus be excluded from the study of other areas of mathematics requiring this concept. This view of time is common: Carter and Richards (1999) refer to the "universal issue/dilemma" of time and "the teachers' belief that if they do not spend enough time 'covering' the 'curriculum' they will be damaging their students". On the contrary, research shows that learners gain conceptual understanding in a problem solving environment despite the fact that a syllabus has not been "covered" (Newstead, 1999).

Assessment

Curriculum 2005 also requires changes in assessment practices. Assessment is no longer used only for summative purposes and for reporting to others, but continuous criterion-referenced assessment is used to diagnose areas of strength and need of individual learners to inform ongoing teaching and learning. Assessment strategies should also provide learners with multiple opportunities in varying contexts to demonstrate what they know and can do (Department of Education, 1997a, 1997c). Furthermore, since one of the goals of Curriculum 2005 is for more

[1] Schwartz and Caverna (1994) regard "mastery learning" as one of two roots of OBE, the other being "competency-based education". While the former is not an aspect of the MALATI philosophy, we would like to emphasise the notion of time as indicated in this description of the role of the teacher in OBE.

children to study mathematics and for longer than has been the case in the past, and since this curriculum recognises a wider range of mathematical skills than was traditionally required, a broadening of the scope of assessment is needed in order to capture a wider range of understandings.

The realisation of these ideals appears daunting to South African teachers practising in the context of an increased work load, large classes and general low morale in the teaching profession. Working within this context, MALATI staff have been supporting teachers in seven project schools in the Western Cape since January 1998 to implement a philosophy of teaching and learning which reflects the fundamental assumptions of Curriculum 2005 and can, we believe, realise the goals of "equity", "redress", "access" and "personal empowerment" by ensuring that more learners learn mathematics for longer than was previously the case.

What is "Equity"?

Apple (1995) uses the term "sliding signifier" to suggest the variety of meanings given to the notion of "equity" in education. The Southwest Educational Development Laboratory (SEDL) (1994) identifies four different definitions of "equity" in the literature, namely, "equity as physical access", "equity as inclusion or capacity building", "equity as multiculturalism or diversity", and "equity as special services"[2].

Khisty (1995) notes that in the past inequalities were regarded as resulting from genetic or cultural deficiencies. This can be contrasted with the view that links failure to the nature of the school system. Oakes (no date) points to the fact that certain "unquestioned *assumptions* that drive school practice and the *basic features of schools*" actually hinder the provision of "equity". SEDL (1994) lists the different aspects of schooling that can provide obstacles to the achievement of "equity": the structure of schooling, for example, "tracking"[3]; resource inequities; teacher expectations and behaviours; curriculum; instructional approaches; assessment; the creation of "at-risk" students; and the culture in and out of school.

Attempts to achieve "equity" could, therefore, involve changes to the allocation of financial resources, changes to content, for example, by attempting to link school mathematics to learners' lives and experiences out of school, and/or changes to pedagogical strategies by encouraging

[2] The first definition focuses on the inputs into education whereas the second uses learner outcomes as the measure of "equity".

[3] Oakes (no date) describes "tracking" as "the practice of dividing students into separate classes for high-, average-, and low-achievers". This system, commonly used in the United States, lays out different curriculum paths for college-bound students and those headed for the workplace.

communication and co-operative learning. The precise nature of these changes will, of course, be influenced by conceptions of the notion of "diversity", for example, whether this is related to diversity in culture, gender, language, socio-economic background etc. The Department of Education (1997c) indicates that differences in age, gender, physical or other disability, culture, background, language, socio-economic status and geographical location should be taken into account.

It is difficult to ascertain from the official documentation precisely what the Department of Education means by "equity". Consider for example the following extract which refers to equal "learning opportunities":

> *In view of the country's history and its legacy of inequality, it is important that the state's resources be deployed according to the principal of equity, so that they are used to provide essentially the same quality of learning opportunities for all citizens.*
>
> (Department of Education, *ibid.*)

Precisely what is meant by the "state's resources" is not, however, elaborated on. Reference in the documentation to OBE on the other hand, suggests that different learners will require different inputs and time frames to achieve their potential.

Mixed-Ability vs Ability Grouping

The grouping of learners with the same "ability" into the same classes or groups within a class has traditionally been viewed as one way of promoting "equity", as the teacher will be able to respond to the different needs of the different groups of learners. Recent research, however, suggests that the assumptions on which this form of organisation rest cannot be supported educationally, cognitively or morally.

From an educational perspective, Oakes (no date) notes that there is little evidence to support the assumptions that ability grouping increases learning or improves learners' attitudes to schooling or themselves.[4] On the contrary, it appears that this form of organisation actually provides **barriers** to achievement of learners, because the placement of learners in ability groups appears to increase the gap between learners beyond the initial differences. This widening of the differences usually results in the lowering of performance of the "weak" learners as low-ability settings appear to impoverish the learning environment which serves the interests of neither the learner nor the teacher. The lowering of the teacher's expectations in such a setting results in a

[4] Oakes uses the word "tracking" to describe the use of ability grouping in the United States. She describes "tracking" as "the practice of dividing students into separate classes for high-, average-, and low-achievers". This system lays out different curriculum paths for college-bound students and those headed for the workplace.

"watered-down" curriculum and more time being spent on management of learner behaviours than on academic pursuits. In such a setting the expectations of the teacher are, inevitably, fulfilled. (Linchevski & Kutscher, 1998; Oakes, *ibid.*).

On the other hand, research by Linchevski & Kutscher (1998) points to the benefits of mixed-ability settings: They indicate that the added gap between ability groups is "nearly non-existent" in mixed-ability settings and that the placement of learners in these settings is not detrimental to the achievement of any learners. Furthermore, from a cognitive perspective, the mixed-ability setting provides for collaboration between diverse learners creating a rich learning environment (Linchevski & Kutscher, *ibid.*)

Oakes (date unknown) reminds us that one also has to consider the "fairness" of ability grouping. Referring to the placement of poor and minority learners in the United States, she warns of the link between track placements and learner background characteristics. She notes that these placements might be acceptable if it could be proved that they provided access for learners into higher tracks. This does not, however, appear to be the case. Viewing this system of grouping in the light of the legacy of inequities in the South African education system, therefore, it would be morally unacceptable to support such a system.

MALATI "Equity"

While acknowledging the importance of the distribution of financial resources and the provision of a curriculum which caters for learners of different genders, cultures, language groups etc. in addressing the issue of "equity" in education, MALATI has, in collaboration with the TAP (Together and APart) project in Israel, developed particular views on the notions of "equity" and "diversity" and an accompanying teaching approach. This philosophy is based on the **high** expectations we have of learners' abilities to do mathematics and is aimed at ensuring that more learners are successful in mathematics for longer than has been the case in the past.

Firstly, it should be stressed that the MALATI philosophy refers specifically to **mathematical** diversity. Our view of "equity" is that all learners can learn **provided they are given appropriate instruction and time**. We believe that an "equity" learning environment can be achieved while retaining excellence and without compromising the mathematical knowledge of any group of learners, whether high- or low- ability learners. The creation of such an environment requires the pursuit of two apparently contradictory goals, for diversity (**mathematical** diversity) is both "acknowledged" and "ignored". By acknowledging diversity we mean that all learners are given the opportunity to fulfil their mathematical potential (and we

acknowledge that different learners will learn at different levels), by ignoring diversity we recognise that certain mathematical knowledge (Indispensable Mathematical Knowledge (IMK)) is required by **all** learners if meaningful interaction in heterogeneous groups is to take place and to allow access into future mathematical activity. In this way a diverse and productive mathematical community can be created – for there is sufficient space for meaningful sharing of mathematical knowledge as well as enough space for learners to express their mathematical diversity (Linchevski, Kutscher, & Olivier, 1999). For a more detailed description of this view see Linchevski *et al.* in these proceedings.

Creating an Equity Environment

Our views on "diversity" and "equity" naturally lead to a particular approach to the selection of study material, methods of instruction, classroom organisation and assessment.

Classroom Organisation and Selection of Study Material: This is planned in such a way that the teacher can keep the class together as a unit, but also respond to the differential needs of learners. Teaching is conducted in four different settings: (a) in a whole class setting (heterogeneous), (b) in small mixed-ability (heterogeneous) groups, (c) in small homogeneous groups, and (d) in large homogeneous groups. The two co-operative heterogeneous settings (a) and (b) are used for the parts of the "shared topics" which are studied by **all** learners (this is known as the "core material"). The shared topics are intended to provide learners with the necessary IMK for meaningful interaction and access to further mathematical activity and are studied approximately 70% of the time.[5] Furthermore, in order for learners to develop "taken-as-shared" knowledge (Cobb, 1996) for meaningful interaction, it is imperative that productive discussion in the heterogeneous groups be maximised.

The homogeneous arrangement is used only if the different needs of learners cannot be satisfactorily addressed in the heterogeneous groups. The homogeneous groups are constructed on the basis of prior achievements on a topic (shared or unshared). When arranged in a homogeneous setting, learners are generally engaged in different activities – these can be for shared or unshared topics. When studying a shared topic, learners study the "complementary material" – this can consist of orientation for learners who do not have the necessary background to study the core material for a shared topic, revisiting of IMK, consolidation of IMK or

[5] Linchevski *et al.* (1999) point to the important role of the teacher in identifying the necessary IMK as well as the learners who have problems with the IMK.

enrichment. Learners in the homogeneous groups can also be given enrichment on unshared topics (Linchevski & Kutscher, 1998b).

Assessment: The MALATI philosophy of teaching and learning has a constructivist basis in that it acknowledges the difference in learners' prior knowledge and experiences. Instruction for each learner is designed on the basis of the teacher's knowledge of each learner's existing understanding of a particular topic. This information is obtained through assessment and each learner is then provided with an opportunity to build on this knowledge. For assessment to play this role, a shift in thinking about assessment is needed, from assessment as a means of reporting to others and for filtering learners into different levels of mathematics and eventually out of the system, to a view of assessment as a **diagnostic tool** to inform the teaching and learning process.[6] The design of these assessments should be in line with the MALATI view on "equity": This requires assessments that accommodate the different ways different learners think about mathematics as well as assessments that provide information on the necessary IMK. For further detail on the nature of these assessments refer to Linchevski *et al.* in these proceedings.

Implementation of the MALATI Philosophy:

Since January 1998 MALATI staff have been supporting teachers in seven Project schools to reflect on and implement this philosophy of teaching and learning. This paper reports on the process of implementation in a high school on the Cape Flats. Support at this school has taken the form of workshops, "window sessions"[7], classroom visits and informal discussions with the six mathematics teachers. Data in the form of field notes, teacher beliefs questionnaires, teacher interviews and video recordings of classroom visits has been collected to assess the impact of the intervention.

This paper focuses on the work of two teachers, Teachers A and B, both of whom are well-qualified in mathematics education and have participated enthusiastically in the project. They have been selected for this discussion because their work illustrates the progress that can be made when implementing the change required by Curriculum 2005, as well as the obstacles to this change as perceived by these teachers.

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[6] This approach does not distinguish diagnostic assessment from other forms of assessment such as summative and formative assessment. Rather, we believe that a well designed test can be used for diagnostic as well as other purposes, for example, for reporting progress to others.

[7] A "window session" is a scheduled period during the school day in which all mathematics teachers are freed from their teaching duties to meet as a group with MALATI staff to discuss and reflect on their work. Discussions focus on issues of content, class culture, assessment etc.

Positive Developments

Motivation to Implement the MALATI Philosophy: The six teachers were introduced to the MALATI philosophy and approach in a window session in May 1998. MALATI staff workers used the analysis of test responses of learners in Teacher A's grade 9 class to illustrate the use of assessment in the planning of instruction and then encouraged the teachers to begin the process of using diagnostic assessment and to request assistance from MALATI staff where necessary. Within a few months it was noted during classroom visits that both Teachers A and B had begun the process on their own. Although these attempts, as discussed below, were certainly not without problems, it was encouraging that the teachers had taken the initiative with respect to the following: deciding on the appropriate time during the teaching process to assess; designing the tests to be used for assessment, undertaking the analysis of the responses; and conducting the process of remediation in the homogeneous groups, formed on the basis of the diagnosis. Teacher A continued to provide extra tuition to some learners during break-times, but this was the first time he was attempting to cater for the diversity of learners during class time.

This process was certainly not easy for these teachers – both before and after his first attempt at diversifying in late March 1998, Teacher A indicated that the concept of having different children in the same class doing different things at the same time was "scary" (he had, in fact, only used two heterogeneous groups). Teacher B attempted to diversify for the first time in two of his classes in August 1998 – after using a diagnostic test in one class, he had seven homogeneous groups doing different consolidation activities. This process was observed to be a great strain for the teacher and he admitted as much. However, the fact that he saw it as beneficial was illustrated in his comment that at least he had made a start and that although it was hard work, it was necessary if he was going to gain a "deep knowledge" of his learners' understanding.

Classroom Organisation: Teacher A has changed from a situation in January 1998 where all the learners were doing the same work all the time, to at times, organising the class into two, and sometimes three homogeneous groups, each of which is given different work. Teacher B's organisation has undergone a similar change, but he seems to be able to cope with a larger number of homogeneous groups doing different work.

Decision-Making: There has been a change in the way the teachers gather information on which they base their instructional decisions. Initially they based these decisions purely on observations made during interaction with small groups and whole class discussions. These decisions were

based on informal interaction with a few learners and the teachers admitted to only spending a few minutes interacting with the small groups. Furthermore, the problems they perceived were then addressed with all learners in a whole class discussion. In February 1998 Teacher A indicated that if fifty percent of the learners working in small groups "know what is happening" then he continues with the lesson and "hopes" that the rest of the learners will catch up during the whole class discussion. Teacher B was observed to obtain a response from one learner before moving on:

> *He asks: "Why is the A indicated on the grid?" A pupil responds, is asked to repeat the answer by the teacher, and then the teacher repeats the answer for the whole class. He indicates on his own copy of the worksheet as he is explaining.* [8]

These teachers continued to use this informal assessment in the decision-making process, but as the year progressed they started to consider additional factors. Teacher B, for example indicated that since he had started using more group work in his classroom, he was able to gain information on more learners. In August both teachers indicated that they took the nature of the content into consideration when making decisions. Furthermore after a few months, both teachers had, as mentioned above, taken the initiative in using short written assessments and then attempting to cater for the different needs of learners in small groups. As noted in the field notes of a MALATI staff member, Teacher A suggested in October 1998 that just one assessment was not enough: "Teacher A indicates that he thinks the remediation has helped the front pupils, but feels that he would need to assess again to be more sure" .

The two teachers also began to focus more on the strategies used by individuals. In August 1998 Teacher B analysed his learners' abilities to perform different isometric transformations and then diversified on the basis of this. He continues to use the learner strategies as a means for deciding how to diversify his classes. When asked what he did when he had performed an assessment, Teacher A replied, "I basically…I take it home, have a look at it so I don't address it within that period, I take it home and split it up into who I think knows what's going on and who doesn't". In general MALATI staff have noticed a change in the focus of all six teachers at the school: Discussions during window sessions now involve teachers' descriptions of the mathematical strategies used by their learners rather than discussion of administrative details.

Views on Assessment: There has been a clear change in the views of Teacher A. Initially he claimed that he used class tests (based on old tests and aspects the learners had struggled with in

[8] Interestingly both Teacher A and B indicated in February 1998 that they were struggling with the decision-making process during classroom interaction.

class) to “gage his success”, as well as informal assessment as described above. During August 1998 he indicated that he used informal assessment and formal assessment which followed departmental policy, as well as his own class tests. He also indicated that he would like to conduct interviews with learners, but found time a problem – he was thus considering using peer assessment as an alternative.

By the end of 1998 Teacher A had begun to feel the pressure of having to “complete” certain content by the end of the year and had started reflecting on the school policy of assessment. The following is an extract from field notes on a window session in October:

> *Teacher A said that the new approach to maths had changed his thinking about assessment: He did not see the point in teaching certain topics just so that they can assess them at the end of the year. He said he was experiencing a conflict between the school assessment system of control tests and examinations and his own ideas on assessment. He said he felt uncomfortable about saying he would cover certain work before the examination. Rather, he would like to continue and then decide at a later date what to assess.*

Early in 1999 Teacher A was the motivation behind a proposal on assessment policy compiled by the mathematics department and submitted to the principal. In response to a suggestion that the school hold “mini-exams” at the end of the first and third terms, Teacher A proposed that assessment be spread out throughout the year, that individual teachers could set their own assessment where appropriate, and that learners be given the opportunity to be reassessed at a later date. Teacher A was very frustrated when this proposal was not accepted but plans to pursue it with the wider staff body in the second term of 1999.

<u>The Concept of Time:</u> Teacher A’s concern about the perceived time pressure exerted on him by the syllabus has been noted above. In February 1998 Teacher B also mentioned pressure to complete the syllabus and indicated that this prevented him from correcting learners’ misconceptions more than once.

There does, however, appear to have been a change in this regard. Firstly, Teacher A, as discussed above, did not want to be constrained by deadlines which he was not sure he could meet before examination time. After making a determined effort to implement the MALATI approach in early 1999, Teacher B was asked for his opinion on the time involved in the process – to our surprise he said he felt he had been working too fast and planned to slow down the pace in the new term. MALATI staff have noted that the six mathematics teachers have, in general, become less concerned about time: During the first months of involvement with MALATI teachers expressed concern that they were not “covering” what had traditionally been taught in

one school year. By the end of 1998, however, concerns of this nature were not raised. Rather the teachers indicated that they would continue in the new year where they had left off in 1998 and, in a number of cases, indicated that they planned to revisit topics already studied. Teachers also requested that they be able to "follow" their learners through into the next grade in 1999. Perhaps the teachers were more in touch with the understanding of their learners than in previous years and were beginning to see the process they were engaged in as valuable.

Perceived Obstacles

Different Learners Doing Different Work: Teacher A has had problems managing more than two different groups of learners doing different work. In an interview in October he indicated that he "couldn't cope" with three different groupings:

Interviewer 2: *What do you think? Why? What was the problem?*

Teacher A: *Ya, let me call the three groups those that understand, those that have difficulty understanding, those that do understand, and those that's basically intermediate. Those that do understand work quite fast and quite well through any activities, so it means planning a lot of activities for them, and they are actually the group that would work quite far ahead, and eventually they need more attention than the group that I feel need to be addressed, especially looking at the work that we are doing now, so it's a small group the group that can do well and time-wise they take up more of the time.*

Part of Teacher A's dilemma when diversifying stems from the provision of appropriate material for the different groups. When he diversifies he gives core material to the group that has been identified as having an adequate understanding of the topic. The learners in this group then get further ahead on the shared topics thus decreasing the likelihood of there being meaningful interaction in the heterogeneous groups. This teacher has also expressed concern about the workload if he tries to provide enrichment activities for these learners. We feel that MALATI has to address this problem in its provision of materials and teacher support: MALATI staff are currently providing teachers with enrichment materials for this purpose as well as designing additional materials for inclusion in the MALATI packages of materials.

Teacher B appears to have been more successful in coping with a greater number of homogeneous groups at a time and providing a range of activities for the different groups (he has also requested enrichment material from MALATI staff). This teacher is, however, very aware of his limitations: In an interview in March 1999 Teacher B indicated that he felt that he could only cope with performing a thorough analysis with two of his classes. In the other classes he did

attempt some diversification, but this was based on a less thorough analysis than in the two classes. He was also considering varying the classes for which he performed a thorough analysis.

Mixed-Ability Groupings: While MALATI staff and the teachers have been focusing on the mechanics of conducting diagnostic assessments and diversifying the classes into homogeneous classes, it appears that the heterogeneous settings have been neglected. Furthermore, it appears that the difficulties encountered in this regard are not only related to issues of practical implementation, but also to the underlying beliefs of the teachers. Perhaps these teachers have not yet had experiences to convince them of the benefits of mixed-ability groupings. In December 1998, for example, Teacher A's responses to the beliefs questionnaire suggested that he was convinced of the benefits of mixed-ability grouping for weaker learners, but indicated that he did not have "enough personal experience" to comment on the benefits for stronger learners in such a setting. Teacher A has been, in his words, "getting to know group work" and has tried different strategies, for example, constructing mixed-ability groups and ability groups and allowing the learners to choose their own groups. In the latter case this teacher only changes these groups if there appear to be social problems between the members. By March 1999 he had begun to form some opinions on the benefits of different groupings, these ideas being based on his ability to manage the situation and the observed interaction between learners in the different groups, rather than on the actual performance of the learners. For example, he indicated that he was hesitant to use ability groups as he felt he could not cope with the workload of having to provide additional work for the "strong" learners. He also suggested that the "strong" learners could work productively in an ability group, but this was not the case with what he termed the "average" or "weak" learners.

In July 1998 Teacher B indicated that the learners had been placed in ability groups – he suggested that in mixed-ability groups the weaker learners will come to rely on the stronger ones and that learners in ability groups might be more motivated to work. During 1999 this teacher has permitted the learners to select their own groups and has admitted that these do end up as ability groups.

Analysis of the data on these teachers suggests that they are not using the mathematical content in making decisions about the appropriate groupings for their classes. The teachers' descriptions of the different groups reflect on their underlying beliefs, for example, the "strong" or the "weak" group suggest that these "abilities" are regarded as fixed, regardless of content.

Identifying and Addressing Problems with IMK: Using MALATI materials for the second time in 1999, the teachers have displayed greater confidence in handling the content and in deciding when to conduct assessments. It does appear, however, that they still feel the need for guidance on identifying IMK, as well as which aspects of IMK require immediate remediation and which can be revisited at a later stage. For example, after providing remediation on integers and then reassessing the learners, teachers noted that some learners still had problems with this topic and they were not sure whether to provide further assistance or to proceed with the next topic. MALATI staff advised them that the topic could be revisited when studying algebra.

The Nature of the Analysis: While Teacher A has taken the initiative to analyse the work of his learners, he tends to use marks as a basis for diversifying his classes:

Teacher A: *It is basically short questions about five questions, which I just quickly write up and it takes about maximum 10 minutes they also mark themselves, than I just collect at the end of the day and group it into certain…who did well, who did not do well, who didn't understand type of thing.*

Interviewer 1: *That is interesting…so you say you classify you group them into who did well, who did not do all that well, and who didn't do well at all. Is it therefore just right or wrong, or do you make another analysis…to try and identify specific misconception so that …(unclear)*

Teacher A: *I don't go into too much depth. It is basically more who doesn't understand who does or have an idea.*

(October 1998)

In an attempt to encourage teachers to focus more on the strategies of individual learners, MALATI staff are currently using a strategy whereby they encourage teachers to spend an extended period sitting with one group, observing the processes in this group.

Additional "Obstacles": Although these teachers are consistently using diagnostic assessment to inform the teaching and learning process, they have not yet seen the way forward to actually setting different assessments for different learners. When assessment is conducted after consolidation this is only given to the so-called "weak" learners who have revisited a shared topic.

A common topic of conversation in window sessions is that of coping with unmotivated learners, many of whom have consistently failed mathematics over many years and who are perceived by the teachers as disrupting the normal learning process. These teachers do not seem to regard the MALATI approach is an appropriate strategy for incorporating these learners into the process. Rather, they would prefer to isolate these learners to prevent them from negatively influencing the progress of those learners who are committed. In Teacher A's grade 10 class, for example, those learners repeating the grade have seated themselves on one side of the classroom – the

teacher accepts this arrangements and indicates that he simply encourages these learners to join the other learners if they wish. At MALATI we are currently debating the issue of how learners such as these with a severe backlog in the learning of mathematics and poor motivation can and should be catered for.

The frustrations experienced by Teacher A in relation to the whole school policy of assessment have been discussed. Furthermore, debates between the teachers during window sessions reveal the teachers' frustration at trying to build a culture of using group work in the mathematics classroom when this culture is not being enforced in other subjects.

Addressing Underlying Beliefs

The implementation of the MALATI philosophy has, as discussed, had some positive impact and MALATI staff and teachers are working at overcoming the practical obstacles to this implementation as perceived by the teachers. Analysis of the beliefs of the teachers and observation of their classroom practice, however, suggest that there is still work to be done in addressing the underlying beliefs of the teachers in this regard and that these teachers are not yet fully convinced of the merits of the system. Areas that require attention are that of the benefits of mixed ability rather than ability grouping as discussed above, and beliefs about the potential of different learners to achieve in mathematics.

The MALATI approach to teaching and learning is aimed at providing a way in which teachers can cope with the diversity in a class during scheduled class time as well as maximising the use of this time. However, Teacher A is still offering additional tuition during break time, in spite of his efforts within the mathematics periods and his admission that very few learners actually take advantage of this opportunity. In spite of their consistent efforts to remediate problems and provide consolidation during the teaching and learning process, both Teacher A and B still see the need to provide time for "revision" before a standardised, summative test.[9]

Conclusion

This paper has attempted to illustrate how, with the intensive support of MALATI staff, two enthusiastic, dedicated and reflective teachers have attempted to implement an approach to teaching and learning which we believe provides a way of achieving the ideals of Curriculum 2005. The implementation of this approach has resulted in some shifts in the thinking of the

[9] It should be noted in this regard, however, that both teachers do diversify the class when conducting such a "revision" programme.

teachers and changes in their classroom practice, but it is clearly a long and complex process. MALATI staff are currently focusing on strategies to deal with the "obstacles" as described above. At MALATI we are conscious of the "luxury" we have had as a project in terms of physical and human resources in providing support to schools. In the light of our experience of the complexity of implementing this approach to teaching and learning under these circumstances, therefore, we are concerned about the viability of effectively addressing the fundamental assumptions and goals of Curriculum 2005 given the scale of implementation and the limited support that is going to be available to the majority of teachers.

References

Apple, W. M. (1995) Taking power seriously: New directions in equity in mathematics education and beyond. In Secada, W. G., Fennema, E. & Adajian, L. B. (Eds.), **New directions for equity in mathematics education**. Cambridge, UK: Cambridge University Press.

Carter, R. & Richards, J. (1999) Dilemmas of constructivist mathematics teaching: Instances from classroom practice. In Jaworski, B., Wood, T. & Dawson, A. (Eds.), **Mathematics Teacher Education: Critical International Perspectives**. London, United Kingdom: Falmer Press.

Cobb, P. (1996) Accounting for mathematical learning in the social context of the classroom. In Alsina, C., Alvarez, J. M., Hodgson, B., Laborde, C. & Pérez, A. (Eds.), **Selected lectures from the 8th International Congress on Mathematical Education**, Sevilla, Spain.

Department of Education (1998) **Assessment policy in the general education and training band: Grade R to 9 and ABET**. Pretoria, South Africa.

Department of Education (1997a) **Outcomes-based education in South Africa: Background information for teachers**. Pretoria, South Africa.

Department of Education (1997b) **Curriculum 2005: Lifelong learning for the 21st century**. Pretoria, South Africa.

Department of Education (1997c) **Intermediate phase policy document**. Pretoria, South Africa.

Department of Education (1996) **Draft recommendations for the development and implementation of assessment policy**. Pretoria, South Africa.

Khisty, L. L. (1995) Making inequality: Issues of language and meanings in mathematics teaching with Hispanic students. In Secada, W. G., Fennema, E. and Adajian, L.B. (Eds.), **New directions for equity in mathematics education**. Cambridge, UK: Cambridge University Press.

Linchevski, L. & Kutscher, B. (1998a) Tell me with whom you're learning, and I'll tell you how much you have learned: Mixed-ability versus same-ability grouping in mathematics**. Journal for Research in Mathematics Education, 29,** 533-554.

Linchevski, L. & Kutscher, B. (1998b) **The TAP Project – Together and apart: Teaching mathematics in heterogeneous classes**. Unpublished manuscript, Hebrew University, Jerusalem, Israel.

Linchevski, L. Kutscher, B. & Olivier, A. (1999) Assessment in support of equity. **Proceedings of the Fifth National Congress of the Association for Mathematics Education of South Africa**, Port Elizabeth, South Africa.

Newstead, K. (1999) "I don't have time to teach for understanding": Reflecting on a time-consuming process of change. **Proceedings of the Fifth National Congress of the Association for Mathematics Education of South Africa**, Port Elizabeth, South Africa.

Oakes, G. (No Date) Keeping track, part 1: The policy and practice of curriculum inequality. Retrieved on 26 March 1999 from the World Wide Web: http://equity.enc.org/equity/eqtyres/erg/111442/1442.htm

Schwarz, G. & Cavener, L. A. (1994) Outcome-based education and curriculum change: Advocacy, practice and critique. **Journal of Curriculum and Supervision, 9,** 326-338.

Southwest Educational Development Laboratory (1994) Equity in the reform of mathematics and science education. Retrieved on 26 March 1999 from the World Wide Web: http://www.enc.org/reform/journals/ENC2430/2430_ovr.htm