Emerging Successes and Tensions in the Implementation of Mathematical Literacy

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Introduction
2006 has been an exciting and challenging year for mathematics educators in the FET band. The implementation of Mathematical Literacy as a new compulsory subject for learners not taking Mathematics in the FET has shown some amazing successes and raised some interesting tensions for Grade 10 mathematics teachers.

In this paper we wish to focus on some of the successes and tensions that we have come across in our work with Grade 10 Mathematical Literacy teachers and students over the past year. This work spans:

- ✧ informal conversations with Mathematical Literacy teachers in schools that we have contact with through our Marang work;
- ✧ participation in a Mathematical Literacy teacher support group;
- ✧ feedback from participants in our Marang Mathematical Literacy activities, workshops and seminars (including our AMESA conference workshop);
- ✧ intensive research with three grade 10 Mathematical Literacy classes in an inner city Johannesburg school.

While there are a vast range of successes and challenges that Mathematical Literacy students and teachers confront on a daily basis we will focus our discussion on the following in this paper:

Successes
- ☑ learners' increased enjoyment of engaging mathematically
- ☑ learners' increased access to mathematical thinking
- ☑ the slower pace which allows for more discussion of contexts and concepts with peers and with teachers
- ☑ learners' increased confidence in their mathematical competence – 'Maths Literacy is different but not inferior to mathematics'
- ☑ a shift in Mathematical Literacy teachers' views from cautious reluctance in the first term to positive acceptance and experiences with Maths Literacy

Tensions
- ☒ The criteria for taking Mathematical Literacy – free choice or streaming according to marks?
- ☒ The effect this has on the morale of the class and others' perceptions of Mathematical Literacy.
- ☒ Is there portability between mathematics and Mathematical Literacy? How do teachers cope with students changing from Mathematics to Mathematical Literacy mid stream?
- ☒ Uncertainty in relation to what matric assessment will look like and what the status of Mathematical Literacy will be in relation to access to further studies.

The intention of this paper is not to engage and debate these successes and tensions at a theoretical level. Rather we aim to share with you some anecdotes (real life stories and quotes) from teachers and students that will illuminate these issues for you and stimulate reflection and thought in relation to your own experiences or perceptions of Mathematical Literacy. We thus invite you to respond to this paper with your own experiences in the next edition of LTM and hope that this paper will stimulate the start of many LTM publications relating to the implementation of Mathematical Literacy.

Before commencing it might be useful for those not familiar with Mathematical Literacy to refer to the following definition from the National Curriculum Statement:

> '*Mathematical Literacy provides learners with an awareness and understanding of the role that mathematics plays in the modern world. Mathematical Literacy is a subject driven by life-related applications of mathematics. It enables learners to develop the ability and confidence to think numerically and spatially in order to interpret and critically analyse everyday situations and to solve problems*.' (Department of Education, 2003, p.9)

Some anecdotes of the successes

In several interviews with students taking Mathematical Literacy in an inner city school with relatively large classes the overwhelming response from all was that they enjoyed their Mathematical Literacy classes. Responses such as the following were common throughout interviews:

"It's very interesting. I actually enjoy it, really I do"

"You won't normally enjoy maths but Mathematical Literacy is nicer"

"our friends(who failed maths in grade 9), the ones we sit with… we help them out – they enjoy it (math literacy), they have fun with it, as if – it's like being in a crèche you learn to play with a new toy"

This enjoyment was not simply about having fun in the Mathematical Literacy class but was about students' increased access to mathematical thinking and understanding of mathematical concepts. This they largely ascribed to increased time to make sense of the mathematics and the contexts and increased discussion with both teachers and their peers. The following excerpts illustrate this:

"And the teachers like, they explain for you until you get it right. They even give you a lot of time, even a week for you to understand. Unlike in maths when they'll just say "aah come back after school for extra lessons, we have to move on". But for Maths Literacy they just give you time until they see that everyone understands. And in class like lots of activities to ensure you understand. And the method of teaching, I found a lot (more) informal… they were not as strict… the topics they allowed us to have fun. Ja now we will land up discussing what we saw in the paper. Ja stuff like that."

"this year, like most of the time we like work in partners groups and all that. So it's much easier to understand than like working alone when you don't understand, you've got no one to ask, so you just keep quiet and do your own work"

"It's like explained in more detail… It's easy to understand"

This increased understanding and competence also seems to lead to increased confidence in seeing the world through a mathematical lens. Several students interviewed explained that their families' perceptions of them and their roles in relation to their families (especially in relation to dealing with finances) changed as a result. Some students explained how their homework activities which involved budgeting with their parents and analysing telephone options led to useful discussions in their homes and new responsibilities for the learners The following extract illuminates this:

"Like every time, each and every month, I'm the one that goes there (the bank) and deposits money, draws some cash and all that…Yes because now we understand the Maths Literacy… we try to do the same thing at home. We want to get our mom – our parents to understand. Now they think we are geniuses and so they want us to do it because they think we are the best"

Some anecdotes of the tensions

From our interactions with several teachers in both state and private schools across Gauteng it would seem that the vast majority of students taking Mathematical Literacy have been advised by their teachers to do so based on their grade 9 mathematics performance. Thus although for some schools there is some level of 'free choice' allowed, in most schools students with weak grade 9 marks are strongly advised to take Mathematical Literacy. Similarly students are strongly advised to take mathematics if their grade 9 marks were good. In one school we know of the decision was made not to offer Mathematical Literacy in grade 10 at all and rather to offer it only in grade 11.

While not undermining the pragmatics of such an approach we note the following consequences:

* many Mathematical Literacy classes have few or no students with strong levels of confidence and competence in mathematics
* other students and parents perceive the Mathematical Literacy classes to be for 'mathematically stupid students'

These two factors jointly affect the morale of the class, which many teachers reported to be very low at the start of the year. Thus quite a lot of confidence- and morale-boosting had to take place in these classes in order to get students to overcome notions that they are mathematically stupid. One teacher we interact with regularly is finding morale and discipline issues to be an ongoing battle due to such perceptions. Many students interviewed when probed made comments such as:

"when you choose Maths Literacy, it's like you know you're a stupid kind of person"

At the school where we are conducting intensive research, a teacher gave the mid-year Mathematical Literacy exam to a grade 10 mathematics class to do. This had great results in terms of boosting the confidence of the mathematics literacy students as the following comment from a student at the school illustrates:

"like they gave the other maths classes our literacy test for the exam… they say the whole class failed the exam. They found it difficult… Then after that she like told them that "you know you've just written a Maths Literacy test" … and it was like "oh it's hard", you see… after they saw what we were doing, they saw that it's a different maths in its own hard way and its easier way because in maths – that plain maths – they are not all the same. I can find geometry easy and you can find it difficult… so we are not all the same. I can't just say it's easy because I find it easy.. Ja they (math lit and maths) are not really the same"

Indeed mathematics and Mathematical Literacy were not designed to be 'the same' and Mathematical Literacy is emphatically not watered down or standard grade mathematics (as the interview with Professor Paul Laridon in LTM 1 showed). Thus movement between the two learning areas 'mid-stream' was never considered in the design of the curriculum. However for many of the teachers we have spoken to movement between the two learning areas is both a necessity and a reality. Thus Mathematical Literacy teachers are faced with mathematics students who move to Mathematical Literacy after failing or struggling to cope with the first term tests or mid-year examinations in mathematics. For most of the Mathematical Literacy teachers we have spoken to this presents a real problem since these students have missed out on quite a lot of work and on the 'orientation' to what Mathematical Literacy is all about. These teachers are struggling to find ways of working with and 'catching up' such students.

However we did speak to one teacher who felt that since she saw Maths Literacy as 'basic watered down maths' she did not feel that students shifting from maths mid-stream was a problem and simply gave students 'self study' to catch up. This should not imply that movement is only in one direction. The

following extract is from a student we interviewed who scored over 90% for his mathematics literacy exam and was encouraged to switch to mathematics due to this strong performance:

Student: *So in our school like, if you chose Maths Literacy or in the first term, if you didn't like it you can change it in the second term. So if you did plain maths you could change it to literacy. So like those who were good in literacy, they had the option to change to (Maths)…*
Mellony: Oh, to change to maths, so you had that option?
Student: *Ja in fact I was forced actually like I should do maths… But I was like…"no, I enjoy this subject". But they even said "okay let's give you another week to think about it… I'm happy, I don't regret choosing Maths Literacy*

Finally the last major tension that we find teachers struggling with relates to the uncertainty about matric assessment (while there are some exemplar matric papers around which were designed by Aarnout Brombacher, these are not being widely distributed to teachers) and the status of Mathematical Literacy for access to further studies. Teachers struggle with this uncertainty in relation to planning the work that they cover and in how to go about setting examinations that will prepare students for matric assessment. This said, there is some indication that the absence of a precedent of matric examinations does seem to be allowing teachers more freedom to engage with Mathematical Literacy at the pace which they feel is appropriate for their students and with materials which they feel are relevant to their students. Thus the driving force of "working towards that matric exam" as we have commonly heard from mathematics teachers in the FET band is happily absent, as exemplified in this quote from one of our research school teachers:

> *"I'm not having to follow a strict timetable where we have to move the work along to cover the syllabus… I'm going much more slowly, I think much more convincingly. It's much less stressful. And there's time for repetition of all kinds of things. It all comes under the heading of less stressful, waiting for the children to understand what is happening, rather than pushing to finish the syllabus."*

Teachers also struggle to explain to students and parents the advantages of Mathematical Literacy in relation to possible future career paths: lack of clarity from higher education institutions as to which degrees and further studies will accept Mathematical Literacy for access is a great worry for students, teachers and parents alike. This lack of clarity has understandably led to students being encouraged to take mathematics 'just in case it's an access requirement'. While higher education institutions are busy finalising their access requirements it does seem that for some institutions Mathematical Literacy (even with a distinction) will not give access to, for example, commerce degrees. The reason why this is worrying particularly for commerce, business and economic related studies is that for some students their interest in these studies is precisely the reason they chose Mathematical Literacy above mathematics. Thus in interviews with several students who had succeeded in mathematics at grade 9 level and were encouraged to take mathematics but chose instead to take Maths Literacy, they indicated that they were drawn to the financial and applied aspect of Mathematical Literacy which they saw as important for their interest in careers such as business, commerce and accounting.

A final note about language comprehension and Mathematical Literacy.
Many of us, ourselves included, anticipated student difficulties with the increased language and comprehension required by Mathematical Literacy due to its more applied, contextualised and 'real life' problem-solving nature. What is interesting is that this has not emerged as an issue with the teachers or students we have come in contact with over the past year. This, of course, does not mean that it is not an issue at all but it certainly does not feature as a major problem which they have felt is worth discussing. When reflecting on possible reasons why this might be the case we have thought that perhaps indeed the slower pace and detailed discussion of context that tends to take place in Mathematical Literacy classes alleviates this problem. Furthermore the language used in Mathematical Literacy applied problems is

more 'real life' and accessible language than the technical language register of many of the 'word problems' that students struggled with in the past.

In a recent workshop on Mathematical Literacy given by Aarnout Brombacher at the Marang Centre, Wits University, Stephen Sproule made the following excellent suggestion: Why not give students and teachers the range of contexts that will appear in the final matric examinations? For example, tell them that there will be a question involving travel timetables, electricity and water rates, telephone contracts and so forth. That way students and teachers can discuss these contexts in detail in class and make sense of technical terms relating to such contexts (e.g. 'per second billing', 'flat monthly fees', 'compulsory itemised billing') prior to the exam. In this way the time required to make sense of contexts and the language relating to these contexts will not hinder students' performance on the problems that they are required to solve. We strongly support this suggestion.

We finish with a response from a student when asked if there was anything else he wanted to add at the end of the interview:

"I feel really good that the Department of Education came up with Maths Literacy because really maths was holding a lot of people back. They would fail a certain section which wasn't really necessary in their lives and they would fail the whole subject. But then with Maths Literacy… I think it really is boosting a lot of South Africans' needs, they're achieving their goals more."

Reference

Department of Education. (2003). National Curriculum Statement Grades 10-12 (General): Mathematical Literacy: Department of Education.