REVERTING TO ENGLISH TO TEACH MATHEMATICS: HOW ARE MALAYSIAN TEACHERS AND STUDENTS CHANGING IN RESPONSE TO A NEW LANGUAGE CONTEXT FOR LEARNING?

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In 2002 the language policy for teaching mathematics in Malaysia was changed from the national language Malay, to English, to be implemented from the beginning of 2003. This gave the curriculum developers and importantly the teachers just six months to prepare for this change. This small study investigated how after 18 months, 22 secondary teachers and 127 students were adapting to this change. Teachers were adapting but still needed crucial support in targeted professional development. They were still working hard to become competent in the use of mathematical English in the classroom. Students were starting to use English in their thinking about mathematics. It seemed that context and difficulty both played a role in whether the students were using English. It is suggested that opportune case studies of this nature are important to be completed on the few occasions that fundamental systems changes are implemented.

Introduction

Language policy for schooling is often bound up with national identity. Changes in language policy are usually mandated not because of in-depth educational research that points in a particular

direction, but because of an overriding political imperative. Hence in Timor-Leste (East Timor) that became independent from Indonesia in 1999 and declared a nation in 2002, it was decided that Portuguese, the language of the original colonising power and the language of only a small, educated elite, would become the language of schooling. The language of schooling for the previous 25 years, Indonesian, was discontinued for obvious reasons. But another contender, the lingua franca of the people Tetum, was not considered since it was not a world language.

Changes in language policy are not always about total language change. In recent years in a number of states of the USA, it has been mandated for political reasons that only English should be used in teaching, discontinuing various modes of bilingual teaching that have been in use for many years. In Australia the help given to the many English Language Learners in urban schools has been gradually reduced so they now only receive some support from "English as a Second Language" teachers, compared to the extensive support that they received in the 1980s. This change has not occurred because of a reduction in need, but political imperatives have changed.

One interesting exception was the reasoning behind the change in language policy for schooling in Papua New Guinea in the 1990s. In Papua New Guinea there was a change from using English from the beginning of school, to one of using local vernaculars for the first two years, and then having a transition year to the use of English. But it seems the impetus for this change was partly based on educational research completed in part in Papua New Guinea that suggested students are better to begin their school learning in their first language, and indeed remain competent in this as they gain competence in the language of teaching.

It is also noted that although language is important, it is one issue among many that impacts on policy and practice. An important

comparative discussion on this wider issue situated in Southeast Asia can be found in Wong, Taha and Veloo (2001).

The small exploratory study reported here focuses on Malaysia. In 1970 a new language policy was implemented for the Malaysian education system with the introduction of the national language Malay to replace English for the teaching of all subjects in Malay, including mathematics. In 2002 a different policy decision was taken. It was determined that from 2003 mathematics and science would revert to being taught in English. However, the remainder of the curriculum would still be taught in the national language. During 2002 the first proposal for change advocated that the policy revert to the pre-1970 position when all subjects were taught in English. However, the compromise position of only teaching mathematics and science in English was reached with the acceptance that these two key subjects in the curriculum were the most globalised, and hence most dependent on a proper command of English. Hence, at the start of 2003 English was used to teach mathematics and science in the first years of primary and secondary schools, and in the second last year of secondary schooling. The implementation has progressed each year by one year level so that by 2008 all year levels will be using English to teach mathematics and science. The quick implementation of the policy ignored pleas from at least some quarters for a more measured pace (Giaw, 2002). Indeed this move by the government was interpreted in various ways and received much press coverage including many letters to the papers, which continued through 2004 (e.g. Anglionby, 2002; Chye, 2004; Ling, 2002; Netto, 2002; Siow, 2002). In the main, the public debate was very similar to the 1970s debate. There were advocates of the importance of educating students using Malay across the whole of the curriculum and hence sending the signal that their culture, embodied in the language, is all embracing. Others argued that in the now globalised world, students' command of English was crucial

for the country's economic advancement. The impact of globalisation on school mathematics is one that is starting to be considered in depth elsewhere and the same arguments evident in Malaysia are occurring in many other countries (Atweh, Clarkson & Nebres, 2003).

It is not the intention of this article to examine the implementation of the government's policy as an example of the interaction of politics and education, although that is a crucial area of research. There have, however been very few studies reported in the literature on how teachers and students adapt to such sudden policy changes, and fewer still on the long-term impact of such changes. This report adds to that literature. In particular it aims to examine the ways the mathematics teachers and students have begun to adapt to this new educational context. It can also be regarded as a case study reporting on what happened in a special context, which may have broader applicability. The context is special in that no researcher is able to change an education system in the way the Malaysian education system was changed in 2002. Researchers cannot make such changes at system levels, as they may be able to in classrooms, just to explore whether such or such a change may be better for students. However when the rare system level change does occur, it is useful if researchers take the opportunity to explore the impacts. These must often be, such as in this situation, of the nature of a case study. However when a number of such studies are completed over varying contexts, generalisations may well emerge for a more comprehensive tale to be discerned.

The second aim for this study was to examine this new context in the light of the mathematics and language literature. To do that effectively a brief review of pertinent literature will be given.

Language and Mathematics Learning

Over the last 30 years the importance of the impact of language on mathematics learning has been gradually recognised (e.g. Austin & Howson, 1979; Ellerton & Clarkson, 1996; Ellerton, Clements & Clarkson, 2000; Halliday, 1978; Pimm, 1987). Mathematics education research now clearly recognises that teaching mathematics in school classrooms is not a language free zone. Of course it has always been recognised that students in mathematics classrooms had to understand the verbally given directions by the teacher for the management of the classroom, whether mathematics was being taught or some other subject. It was also understood that students would need to be able to read the words that were in textbooks, teacher produced handouts, on chalk / white boards, and these days on computer screens. However, there was little recognition that there is a mathematical language that certainly overlaps the teaching language used in the classroom, but is also distinct from it. At the simplest level of vocabulary, in English there are the common logical words such as if, therefore, implied and so on that we use in everyday language but are also at the heart of mathematics (Clarkson, 2003). Then there are some words such as average or half, which in mathematics have a very precise meaning, but in everyday English we often use in a more general way. Thirdly, there are words that are rarely if ever used in everyday English and are only used when mathematics is being done, such as hypotenuse or weighted mean. But the mathematical language genre is far more than just words. Beyond vocabulary are the ways in which we use the language in mathematics. For example, when doing some type (but not all) of mathematics we may well frequently use particular symbols to convey understanding. However, in school mathematics it is rare that there is a page of only symbols. Some words are also used, but the sentence structure within which the words sit are also often quite different to that of normal English. The concentration of

logical connectives is also noticeable. In other words what is being described in part is the mathematical language register of English. All languages have this type of register, although they will not be exactly the same as that for the English language.

The above is sufficient to emphasise that in doing mathematics it is not divorced from the teaching language. But the mathematical register of the teaching language is of particular importance in doing mathematics. Hence doing mathematics is not just the manipulation of the appropriate mathematical symbols, a misunderstanding often found in schools. Dealing with this deeply ingrained misunderstanding at the school level is still an ongoing task.

For students doing mathematics it is more than listening to or reading instructions, and then doing some symbol manipulations. The notion of doing mathematics also incorporates the students becoming creative thinkers and makers of mathematics and then being able to communicate their ideas to others, as well as to themselves (Lim & Chan, 1993). But it is not always an easy task trying to make sense and understand mathematics as Rahman, Yusof and Mason (2005) noted. Each of these activities to some extent relies on the employment of language, and hence a command of the particular mathematical language that is relevant to the level at which the student is studying. The creative use of text can also lead students to think more deeply about what it is to do mathematics (Chan & Mousley, 2005).

One particular context that is important in the study of language and mathematics learning is when there is a mixture of languages in the classroom. There are a variety of situations when this may occur. For example there are the common situations in Australia where migrant children from different backgrounds often find themselves having to rapidly learn English the teaching language, when at home they will speak in the language of their homelands (e.g. Vietnamese, Italian). In Papua New Guinea and in Brunei

students will come to school knowing two or three languages, and then by year 4 be learning in English, a language they probably will not use any where else but in the school classroom. Similar situations occur in many places throughout the world and have become sights of interesting research in mathematics education (e.g. Barton, Fairhall & Trinick 1998; Barwell, 2003; Gorgorio & Planas, 2001; Idris, 1999; Setati & Adler, 2000).

A naïve position is often promoted that if students, for whatever reason, are using a language for schooling other than their home language, then it is best for them to work only in the school language and not be encouraged to make use of any other languages. Apart from this being an almost impossible position for learners to achieve, building on the work of Cummins (1991), it has been shown that multilingual students will use their different languages when doing mathematics. Indeed high competence in both their home language and the language of schooling does have positive cognitive outcomes for them (Clarkson, 1992; 1996; 1997; 2002; in press; Dawe, 1983). Given this result, what teaching strategies should be used to build on the students' competencies has become another area of research (Clarkson, 2004). In light of this past work, the new context in Malaysia since the introduction of the policy mandating the use of English for the teaching of mathematics seemed to be a fascinating situation. Clearly many more students in Malaysia now find themselves in a position of learning mathematics in a language other than that of their home language. How they respond to this and how their teachers manage this transition are of great interest.

The Malaysian Context and the Present Study

Malaysia is a multi-ethnic nation. The dominant group are the Malays who speak the official language of Bahasa Melayu (Malay). There are significant minority groups of ethnic Chinese who mainly speak Mandarin, ethnic Indians speaking Tamil, and a number of

traditional tribal groups who speak their own vernaculars, notably in the states of Sabah and Sarawak. Some of these groups have their own schools using a teaching language other than Malay, although Malay language studies are a prominent part of the curriculum. However the majority of students have attended government schools where up until recently in most of these schools the teaching language has been Malay for the entire curriculum. For most of these students (the exceptions being Chinese, Indian and tribal group students) that has meant the use of the same language for use in the home and at school. With the change of government policy for the teaching of mathematics, many of these students have been placed in a position where they need to become bilingual learners. It should be noted that the learning of English as a second language has been part of the school curriculum. Hence these students are somewhat familiar with the English language. But it is a very different thing to be learning a second language when it is part of the school curriculum, and another to not only be learning a second language and also use that language as the vehicle for learning another subject, such as mathematics or science.

As noted earlier, multilingual students do use their multiple languages for learning mathematics. This study was developed in 2004, and hence Malay second year secondary students would have entered a comparatively new language learning situation in mathematics some 18 months previously. It seemed interesting to see whether they had begun to use both their languages when doing and talking about mathematics, or whether they predominately used Malay or the new teaching language of English.

One of the influences that has been shown elsewhere to impact on students' language use is the difficulty of the mathematics (Clarkson, 2004; in press). Hence in this relatively new situation it would be of interest to see whether this issue was having an influence on the Malay students. Context is also another important

influence on language use. People know that language can be used in a variety of ways. Choosing the way we speak often is dictated by the situation we find ourselves in. This is true for both mono and multilingual speakers. For multilingual people they will more often than not respond to a question in the same language in which it was asked, or at least initially. Part way through an answer they may well swap to another language if a better expression can be used in the explanation. Past research has shown that students will also swap languages when doing mathematics dependent on the context of learning (Clarkson, in press). Hence, the impact of contexts on Malay students when in mathematical situations was also of interest.

Most teachers in Malaysian schools have some fluency with English. However, conversational competence in a language is not normally sufficient for teaching in that language. Normally competence in the specific academic language in the teaching language is needed; in this case at least some fluency with the English mathematical register. With the change of policy mathematics teachers were put in the position of trying to very quickly grasp the intricacies of the language of teaching mathematics in English. As noted above, although there are mathematical registers in every language, there may be differences peculiar to a language. Hence for these teachers it was more than a simply transliteration from Malay to English when it came to teaching mathematics.

In light of the changed government policy that has led to the teaching of mathematics in English in Malaysia since 2003, the following questions were thought to be worth investigating in a small explorative study;

In the opinion of the teachers:

1. What support has been given to teachers?
2. What changes were made to the curriculum?

3. How are the teachers adapting?
4. What impact has the policy changes had on students so far?

Concerning the students:

1. How does the student's context impact on their language use?
2. What language do students choose to use when doing mathematics?
3. Is there any indication that the difficulty of the mathematics may be associated with using a particular language?

Methodology

Teachers

Rather than using survey methods it was decided to talk directly to teachers. In this way richer data steeped in personal experience were more likely to be revealed, although it did mean using a far more restricted group of teachers than might have been the case if a survey approach had been taken. A series of three Focus Groups were held with different groups of teachers, and a fourth with teachers college lecturers. There were also ongoing conversations with individual doctoral students and various Faculty of Education staff at the University of Malaya over a period of two months in the middle of 2004.

The first Focus Group was held at a secondary school in Kuala Lumpur. In attendance were the Head of the Mathematics Department and eight other teaching staff. All participated in some way during the hour long conversation held during a lunch time. The second Focus Group was held at a second secondary school with the Principal, Deputy Principal, both who had taught mathematics in the past, and four other staff members. This conversation lasted for some 40 minutes during the lesson immediately preceding, and then through the morning break. These

two schools were in middle class areas of the city and would be regarded by many as average or typical of government schools in urban areas of Malaysia. The third Focus Group was held with seven doctoral students of the University of Malaya, all of whom were teachers on study leave from their schools. The fourth Focus Group was more informal and was held during the lunchtime break of a day long seminar for Mathematics Education teachers college lecturers at which the first author had been invited to be present. The group comprised five lecturers and the meeting lasted for 30 minutes. Each of these meetings was structured around the four questions noted above. Extensive field notes were taken during each of these sessions. Within two hours of each session these notes were reviewed and discussed by the first author with a non-participating colleague who had been present during the Focus Group. Additional insights and interpretive comments were appended to the field notes.

Students

A single data collection instrument was developed for the students. The first section was a mathematics achievement test of nine items. The second section was termed the 'Students' Language Use Survey in Mathematics'.

The main reason for beginning the instrument with a mathematics test was to have students complete some mathematics that they had to think about, immediately before completing a survey that asked them to reflect on their thinking when doing mathematics. The test was developed by a local teacher and was based on the types of test items that she and her colleagues would commonly give to their students. The items were designed to be on the more difficult side than normal so that the mathematics the students had to engage with was not trivial. It can be assumed that students were dealing with mathematics in a form with which they

were familiar. This approach had been used successfully in a different context (Clarkson & Leder, 1984). Four items were mainly composed of symbols, and the other five were common 'word problems' (see appendix for the test). The alpha reliability for the test was an acceptable 0.69.

Early in 2004, the authors developed the 'Students' Language Use Survey in Mathematics' with help from the doctoral students referred to above. A short written introduction to the survey emphasised that it was not a test. The first survey item began by asking the students what languages were used in their homes. The next set of nine items asked them to indicate the extent to which they used Malay through to English in solving the nine items of the test that they had just completed. It was hoped that the immediacy of having just completed the test would allow students to reflect more accurately on their language use. This was based on a successful technique used previously (Clarkson, 1996). Further items asked about their language use when doing mathematics when they were thinking, then talking to friends, their teacher, and people at home, and finally when they were doing their mathematics homework. The initial edition of the instrument was piloted with a year 8 class not involved in the main study. After this trial certain modifications to wording were made to ensure students would have few problems with meaning.

In the main study, the classroom teachers of five grade 2 secondary classes from the same secondary school administered the instrument. The school was in a middle class area of Kuala Lumpur and was regarded to be a typical secondary school. It would have been better to use more than one school in collecting this data. However given the resource and time constraints, and exploratory nature of this project, it was thought sufficient to use one school. The teachers gave the students 20 minutes to complete the achievement test. They then led the students through the survey,

emphasising that the survey was not another test, but was a way of collecting data on what languages they used to think in when doing mathematics, and what language they used when talking to others about mathematics. At no point did the teachers have to explain the meaning of any survey items.

Results

Teacher Results

It is useful to report the insights that the teachers and lecturers shared using the four questions that structured the Focus Group and individual conversations as sub headings.

What support has been given to teachers?

The Ministry of Education from October 2002 had provided intensive immersion courses for teachers in 'English for teaching mathematics and science'. These were composed of both face-to-face instruction and self instructional packages. Interestingly, few participants of the Focus Groups specifically referred to this course. In the main teachers referred to the in-school support provided informally by their colleagues when they needed help with using and extending their English. However, the few who did comment on the official 'training' courses appreciated them and felt they had helped both their confidence and abilities with the language. There was a consensus view that 'training' was needed, and should be provided for at least the next five years so teachers became fluent in mathematical English.

What changes were made to the curriculum?

The curriculum had been rewritten in English and the opportunity was taken to update some sections. The opportunity also had been taken to publish an interactive CD for student use. There were some teachers who felt that the mathematical content had been made a little easier. The teachers were critical of the teacher support material,

and in particular did not think that the scripted extended lesson plans in English were much help.

How are the teachers adapting?

Two of the teachers who participated in the discussions were old enough to have started their teaching careers when English was used to teach all subjects. They noted that the move back to English for just mathematics and science seemed to be much more difficult than when they had to move to doing all their teaching in Malay. Others noted that 2003 (the first year they had to use English) had been a traumatic year, but they were finding the going a little easier now.

It became clear that a number of teachers felt they were not completely fluent in conversational English, let alone the academic English required for teaching mathematics. Since many do not live in an English speaking home environment, and for other areas of their teaching they use Malay, they do not get that much continual practice with English. Hence the correct English mathematical terms do not always come immediately to mind, nor the correct way of expressing certain ideas in English, when they are teaching mathematics.

One particular aspect of language that can be difficult is that of listening. Listening carefully to students talk, and in particular focusing on aspects of the student talk that may need correction, is a key to good teaching. This is particularly difficult when students are working in small groups, a teaching strategy that these teachers had been encouraged to use and were trying to do so at times. The teachers in the Focus Groups recognised this issue. Staff from the teachers colleges and university also commented on the issue of carefully listening to students' talk, some noting that they too had experienced the same difficulty in their own teaching of tertiary students.

What impact has the policy changes had on students so far?

There was a consensus that they did not have to worry too much with English when teaching high achieving students. The given wisdom was that these students often came from affluent homes where English is often used each day, so the change in the teaching language will have little impact on their learning.

However with the weaker students there are difficulties. Often the teacher is forced to revert to Malay so these students will understand at least something in the lesson. These students often get lost in the English vocabulary, let alone being able to understand or express themselves in a conversation held in English. It seemed that once the students had gained some cognitive understanding, the teacher rarely reverted back to English to go over the same material. The teachers considered that this would take up too much time, and they would not be able to get through the set curriculum.

When posed with the situation 'What would they do if an average ability student responded in Malay to a teacher's question posed in English', the teachers' first response was that this indeed was common. They followed on by saying that they would frequently respond to the student by rephrasing the student's response in English. They suggested it was not appropriate to expect the student to do this since by using Malay they had already showed they were having difficulty with English.

When asked what they would do if they overheard a small group conversing in Malay during class, rather than English, the teachers said they would let it go and not intervene. It was the students' understanding of the mathematical concepts that was the important thing. However, when it was time for the group to report back to the whole class, then the teacher would encourage the use of English.

A scenario was put forward describing a student completing a mathematical problem and swapping between their languages during this process, either in their own thinking or in conversation

with other students. The question was posed whether this might help, hinder or have no impact on the student. In their answer it was clear that neither the teachers nor lecturers had any knowledge of the literature dealing with bilingual students learning mathematics.

There was a general feeling that the students realised that this was a difficult time for the teachers. At least one teacher acknowledged how supportive her students were, "As they learnt together".

Student Results

Of the 180 students who completed the test and survey, 71% of them spoke Malay in their homes (see Table 1).

Table 1
The Main Home Languages of Students (N=180)

Main language spoken at home	Percentage
Malay	71
Tamil	2
Chinese	3
English	7
Other	10
No reply	8

The students who spoke Malay at home (71% of the total 180, or 127) became the focus of the remainder of the study. These students indicated that they also spoke Malay almost exclusively with their friends both at school out of the classroom, and out side of school.

Language use is normally context specific. Students were asked to indicate whether they used Malay exclusively, a mixture of English and Malay, or English exclusively in five different contexts (see Table 2). In all situations although there is clearly a spread of language use, in the main students opt to use mainly or only Malay. It is no surprise that this is so in the context of talking to friends and

family. Slightly more use of English is also understandable when conversing with the teacher, since the teacher is now structuring the lessons using English as the predominant language of communication. However students in the solitary contexts of doing their homework and when doing their own thinking about mathematics in school, seem to be edging towards the use of English.

Table 2

The Extent to Which Students Use Malay and / or English in Different Contexts (Numbers give the percentage of students for each cell in the table, N=127)

Contexts	Only in Malay	Using a lot of Malay, with a little English	Using Malay & English in about equal amounts	Using a lot of English, with a little Malay	Only in English
In a mathematics lesson, I think …	22	29	29	13	6
I talk to my teachers about mathematics …	22	39	16	9	13
I talk to my friends about mathematics …	46	40	9	5	0
I talk to my parents / brothers / sisters about mathematics when doing my homework in …	46	40	10	3	1
When I do my mathematics homework, I think in …	33	27	20	13	6

The average on the test for these students was 4.1 (possible maximum of 9) with a standard deviation of 1.9. Hence the students found this test reasonably difficult. However two students obtained full marks and only three were given a score of zero. One suspects

that there were a few students for which many items were simply of the immediate recall type. Given that the main reason for giving the test was to situate the students where they would be thinking mathematically, it seems we succeeded.

In the survey, students were asked what languages they used when they had completed the nine test items. They were asked this immediately on completion of the test. Hence the students were thinking back only five minutes to an immediate mathematical situation in which they had been. Their responses are shown in Table 3.

Table 3
The Extent to Which Students Use Malay and / or English for Different Test Items (Numbers give the percentage of students for each cell in the table, N=127)

Item	I only used Malay	I used a lot of Malay, with a little English	I used Malay & English in about equal amounts	I used a lot of English, with a little Malay	I only used English
1	26	32	10	10	22
2	23	36	15	10	15
3	20	42	16	9	13
4	24	29	19	13	15
5	20	29	16	11	24
6	22	33	11	15	20
7	25	33	22	11	9
8	20	36	11	12	21
9	24	24	16	19	17

Fifty per cent or more of students used mainly or only Malay to solve seven of the items. The other two items had 48% and 49% students using mainly or only Malay. Hence most students reflecting on this immediate mathematical experience indicated a preference for the use of Malay. But there were four items that 20% or more

students indicated they only used English. These items (1, 5, 6, 8) unsurprisingly were composed only of symbols. However only 6% of students indicated they only used Malay when attempting to solve all nine items, and 5% only used English for this.

As indicated earlier, the literature suggests there may be some association between difficulty and language use. Three approaches were used to investigate this matter. Firstly, the correlation between the average score for each item and average 'language use' for that item ('using only Malay' was scored '1' through to 'using only English' scored as '5') was a small but significant positive value of 0.35 ($p<0.05$), indicating that the higher use of English when solving an item was positively associated with a higher score on an item. Secondly, the correlation between a student's overall test score and their overall preference for using English (measured as above) on the test was calculated to be 0.18. Thirdly, a comparison between comparatively higher users of English with lower users of English was made. The eleven students who indicated they on average used English most of the time in solving the nine items (4.5 or above) had as a group a test average of 4.8 with a standard deviation of 2.3. The 16 students who indicated they on average used Malay most of the time in solving the nine items (1.5 or below) had an average of 3.5 with a standard deviation of 1.5. The difference between these was shown to be statistically significantly different ($p<0.05$) using a t-test.

Discussion

It is pleasing to note in the teachers' responses that at least some of them have welcomed the professional development support that the Ministry has put in place. The teachers make a telling point in that they wish to see this type of support offered for a number of years into the future. Clearly they are still finding their way in this new situation and perceive the need for professional support. The

programme of professional development has continued up to the time of writing, but it would be interesting to monitor the type and length of support that the teachers receive in the coming years.

The teachers also make some useful points concerning the type of professional development that would be of greater support to them. The teachers are to be congratulated in turning to their own colleagues for immediate support in this new teaching context. Immediate seemed to have two meanings in this context. The first was spatial and referred to training in the teachers' immediate space, their schools. At the time of writing the Ministry is using a 'train the trainer' model for professional development. Ministry experts are training selected 'trainer teachers'. It is then expected that these teachers will in turn organise professional development at both district and school levels. Although it appears that this is certainly happening at a district level, it is not happening at the school level, the place where the teachers in this study had hoped it would materialise. The second meaning of the teachers' feedback was immediate timing. In other words they were hoping for professional development that had elements of 'just in time learning'. This is perhaps more difficult but the use of web based material that is immediately available to teachers, and that also incorporated blogs to enable teachers from different schools to communicate directly and quickly, may be worth exploring. That teachers need professional development that is timely and given in their workspace are part of the framework that Clarke (1994) has developed from studies in the USA and Australia. It may be that such a framework may be applicable in Malaysia, although cross-cultural issues would need to be considered (Bishop, 1992).

It seems that the didactic extended lesson plans have not found favour with the teachers. The teachers seem to be more interested in teaching strategies of more depth than instrumental helps. O'Brien (2004) has noted that many teachers in Australia are also

interested in educational theories, which underlie the important day to day teaching strategies, that are more often than not the only content of professional development programs. The same may be true of at least some Malaysian teachers. One such issue that may be developed is that of helping teachers to 'listen' when mathematical English is being used. This language ability is often relegated behind those of speaking and reading, and to a lesser extent, writing. And yet with the strategies now encouraged for the teaching of mathematics, listening carefully to students has become a crucial ability for teachers to master.

It seems that one of the important language teaching strategies in mix language contexts is known and used by teachers. That is, swapping back to the student's home language when they are unable to use English to discuss mathematical ideas, but then reverting to English and summarising the ideas again in that language before moving to the next issue. Good though this result is, the teachers neither see the need for this when working with the brighter students, nor do they believe they have time with the weaker students to utilise this strategy. Teachers should reconsider both of these situations more carefully. If the brighter students are going to have a sure foundation for building their expertise, their command of the English mathematical register needs to be ensured by regular interactions with the teacher, and indeed elaborated. One way to do this checking and rechecking is to swap between the student's home languages to tease out any different nuances that may be present in one but not the other language. For the weaker students, building up their mathematical register in English is the only way that they will be able to gain command of critical communications. Therefore paradoxically it may be better to spend time on this and forgo some of the set curriculum, than the reverse. This whole matter seems to us to be a key issue that needs to be developed with teachers in their ongoing professional development.

Coupled with the teaching strategy noted in the last paragraph, teachers also need to have knowledge of and access to the literature that deals with how multi lingual students use their languages in learning mathematics. Again this could well be something to pursue in the Ministry's ongoing professional development program.

The analyses of the student data gave results that were in line with what has been found in other studies (e.g. Clarkson, in press). Context for the students does have an impact on what language they are using when doing mathematics. Although it would be expected that discussion at home would continue to be mainly in Malay, it will be interesting to track any changes that occur in the students' discussions with their teachers and friends. Will the teaching language of English become more frequent, or indeed the preferred language of communication for mathematics with these audiences?

Of real interest in this data is the higher use of English than might have been expected after such a short time when the students were in private completing their homework. Is this an indication that the Malay students are not worried at experimenting with the use of the teaching language in their private thinking? This conjecture also found support in what might be higher than expected use of English when the students were individually completing the test items. Clearly there is need for more research at the individual level with use of student interviews and classroom observations to tease out more clearly what is happening. One might expect the trend of students using English to increase into the future. Whether this trend occurs with all students, or deferentially by the higher achieving students, would be worth exploring.

The data in this study gives no indication of whether students were swapping between languages when they were doing the mathematics. Other research suggests that it is the swapping between languages that can be of benefit to students resulting in a

deeper understanding of the mathematics (Clarkson, in press). An investigation into whether students appreciated that they had choices of language based strategies, and whether they were purposefully choosing at particular times to use one of their languages as opposed to the other, and why, would be very worthwhile.

The analyses also support the notion that the level of difficulty of the mathematics did have some impact on students' language use, although the results were not clear-cut. It might be conjectured from these results that the facility of an item was associated with higher use of English, in that students were prepared to use, for them, new strategies (English) to try and solve a problem that was not yielding to their normal strategies. The students who used English more of the time seemed to outscore students who were relying on Malay. One factor to note here was that the test was written in English. Hence it may be that students who were translating back into Malay may have been making translation errors. Clearly the analyses used in this study are correlations and t-tests, and therefore only indicative. More robust data and sophisticated analyses, including student interviews, will be needed to tease out the inherent possibilities.

Summary

This small explorative study has gathered data from both teachers and students about 18 months after the implementation of a new language policy for teaching mathematics in Malaysia. The policy seems to be having an impact. A number of students are beginning to communicate and think in English at least some of the time when doing mathematics. A number of key issues have been identified that could be incorporated into what is hoped will be the Ministry of Education's ongoing professional development for teachers. The student analyses have also identified a number of intriguing issues

that could be the basis for a number of ongoing research studies. The context that has occurred in Malaysia gives rise to an unusual situation that should be used by education researchers to track changes over time as this new policy gradually is bedded down into the system and becomes the norm.

Notes: The first author was supported in this research project by a secondment to the Australian Catholic University's Institute for Advancing Research for 6 months in 2004, and was therefore able to visit the University of Malaya twice to interact with staff and students. This followed an earlier visit in 2003.

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Appendix

Mathematics Achievement Test

Instructions: *Write your answers in the spaces provided*

(In the original, the test was set out on a full page)

1. 30 % of 70 = ……
2. A pupil obtained 32 marks out of 70 in a test. His marks in percentage is ……
3. Aziz has RM 70. He donates 14 % to a charity fund. What is the amount donated? ….
4. If +92 km means 92 km to the right, then -92 km means, 92 km to the ……..
5. – 8 + 5 = ….
6. 2 x - 3 – x + 4 = ….
7. The perimeter of a rectangle measuring (3 x - 1) cm by (2 x + 5) cm is ……
8. 2 kg 35 g = …. kg
9. A bus left Mersing at 2045 and arrived in Kuantan at 0703 the next morning. The time taken for the journey is …..