

## Teaching Mathematics and Science in English: A Perspective from Universiti Putra Malaysia

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## **Introduction**

In the fourth Conference of the Asian Association on National Languages in April 1977, the use of Bahasa Malaysia in the teaching of natural sciences, and biological subjects was discussed. Among the problems highlighted were that of terminology, shortage of teaching staff, cultural problems, and availability of texts and cross references. There was also a general consensus among the participants about the inadequacy of translated texts. Due to the rapid pace of progress in science, many of the texts were out-dated by the time they see print (Asmah and Noor Ein (Eds.), 1981, pp.272-285). Twenty-six years later, the problem with translated texts became one of the catalysts of education change which is especially cogent against the backdrop of even more rapid advances in communication and in science and technology in the new millennium.

The era of information explosion is more than a reality. In the context of the social realities of which, manifestations are often dictated by the cry of "survival of the fittest" in this global and borderless world, policy makers will need to take stock of existing situations and exert their role of being prime movers of change for the common good of a nation and its people. In effect, education is regarded as 'a programme for social survival which is always relative to the society for which it is designed' (Tollefson, 2002, pp.21-22). The K-Economy master plan drafted by the influential Institute of Strategic and International Studies (ISIS) in Malaysia proposes a major overhaul of the education system to prepare young Malaysian to respond to the challenges and opportunities of an ever advancing knowledge-based society (New Straits Times, 22 May, 2001 cited in Ho and Wong, (Eds.), 2003).

Our recent ex-prime minister of Malaysia, firmly set the mood and tone for educational change when he declared:

“The use of Malay can be independent in the books and courts of law in public administrations and local education and government. However, many tried to make it a language of Mathematics and Science and it became not viable. Do not wait for translation or for books because the Internet is here. Nobody is going to translate the wealth of information in the World Wide



Web into Malay for us. We have to master English only  
then can we navigate cyberspace."

(The New Straits Times, February 6, 2001)

However, the problems associated with the mastery of English have long been a topic of hot debate. While recognizing English as an important global language, laments about the poor mastery from every quarter of the education sector abound. That standards have declined (though by whose standards is an argument) have time and again surfaced in many academic discussions with no panacea in sight. The need for a policy change is imminent. The problems, brewing effervescently in a cauldron, need to be taken by their horns. What begs to be answered is "how" and 'when'.

The speed of policy change is often indeterminate. The formal recognition of the need for change finally culminated in the bold step taken in 2002, with the announcement that Science and Mathematics are to be taught in English for Form 1, 4, and Lower Six classes. It heralded a flurry of chain actions and reactions that did not spare any strata of the education system. From the primary to the tertiary level, the affected agencies and institutions had to quickly put their plans in place and into action to achieve the stated goals. Universiti Putra Malaysia was no different. By virtue that it has a training programme for Mathematics and Science teachers, attention has to be given to the 'how' of equipping the trainees with the necessary English skills in order to be ready for the job market.

### **The training programme**

Teachers are the main implementers and advocators of change. How they are trained and their makeup will affect policy change. Any policy change will have to ride a transition period. Naturally, the current trainee teachers in UPM were caught in this transition for when they were enrolled into the course, there was no provision for English language training for subject teaching. As a result of the policy change, the curriculum planners inevitably have to innovate. As an interim measure, an intensive course specifically designed for the teaching of Mathematics and Science has to be created.



### UPM English Proficiency Courses

The UPM proficiency courses were in fact designed as an extension of the Malaysian University English Test (MUET) which is used as a benchmark to gauge the English language proficiency of students who enter the tertiary institution. The first release of the MUET results in 2000 reported that a majority of students obtained only Bands 1 and 2. However, the minimum level expected of students is Band 3 for most of the courses in UPM. Band 3 refers to a 'modest user who has a fair command of the language.' On the whole, students entering tertiary institutions do not have a high level of proficiency in the English language.

Among the tertiary institutions, it may be noted that there exists a democratic practice in curriculum development, as there is no formal directive that dictates courses must be similar across institutions. More often than not, courses offered in each institution are very idiosyncratic as each institution designs their own courses according to their perceived needs of students and other operating constraints. In UPM, the current courses that cater to students with differing levels of proficiency are as follows.

Table 1: English Language Courses in UPM

	Type of Packages	Entry Requirement based on MUET
1	<b>Basic Course</b> BB12409: English for Academic Purposes	Band 1 and 2
2	Electives: Level 1 BB12410: Skills in Grammar BB1241 1: Reading and Discussion Skills BB12412: Academic Writing Skills BB12413: English for Occupational Purposes	Band 3
3	Electives: Level 11 BB12414: Oral Interactions BB12415: Report Writing BB12416: Business English BB12417: Public Speaking in English	Band 4 and above



The underlying principle of the design is to allow students a reasonable choice in courses that would help to strengthen specific areas of their English skills. As can be seen, there are no ESP courses that cater specifically to the use of English for Science or Mathematics. The courses were designed for general and specific skill use in academic contexts.

The main teacher-training programme for MST is jointly conducted by the Faculty of Science and Environmental Studies with the education component provided by the Faculty of Educational Studies. In the demarcation of academic roles, the responsibility of conducting English Proficiency courses has always rested on the Faculty of Modern Languages and Communication. Thus, a larger partnership had been forged across faculties to further accommodate new demands.

### **The Intensive English Course**

The intensive English course for the MST is carried out in addition to the existing English courses that students have to take. This course was first conducted during the one week break of the May 2003/2004 semester followed by 7 weeks of instruction with 4 contact hours per week. The intensive course was apparently a stopgap measure as it fulfills an immediate need upon immediate request. Some of the problems faced inevitably were: shortage of teaching staff, lack of teaching materials and training in material preparation for the course.

A noticeable occurrence during the course was the poor attendance by the MST. Many reasons could account for this phenomenon. From interviews conducted, some possibilities were the poor timing of the course which coincided with the term break, the status of the course in the university curriculum, which was accorded an 'out of the curriculum' standing. Miscommunication between administrators and students was also cited as a hindrance to course efficiency. Some of them reported that they did not think that the course was compulsory to attend. Motivation also appeared to be low.

To solve the problem of materials, the quickest way was to resort to available and prepared texts. In this instance, the teachers identified Zimmerman's, *English for Science* as a text for the course. However, from students' feedback, the book by

Zimmerman has already been used in previous English classes during their matriculation years. This information would rule out further use of the book as a text for the English course.

### Perceptions of the Trainee Teachers

Understanding the affective domain of the MST may have a bearing on student learning and the adoption of approaches for instruction. Knowing teachers' reactions builds up the knowledge base about impinging forces that have an impact on policy change. The MST profile could help programme trainers in identifying specific aspects of their feelings that in turn would help in the tailoring of courses that are relevant to their needs. The data for this source of information came from forty-three final year students from the Faculty of Science and Environmental Studies of Universiti Putra Malaysia who took part in a questionnaire survey. These MST are trained to teach Mathematics and Science in secondary schools. Their age ranges from 20 to 25 years old and 95% of them is Malay and the other 5% is Chinese.

Table 2: Confidence in Teaching English

0= not applicable, 1 = do not agree, 2= quite agree, 3= agree, 4= strongly agree

<b>Confidence in Teaching English</b>		0	1	2	3	4
1	I am confident about using English to teach Mathematics and Science.	8	32.6	30.2	24.4	4.7



### **The Questionnaire Survey**

The questions asked covered a range of concerns such as the MST's confidence level, level of motivation in the learning of the English language, the amount of exposure to English and their language needs.

The survey showed that the MST were not very confident in using English to teach Mathematics and Science. Only a very small minority (4.7%) stated that they were very confident in teaching Mathematics and Science in English while a considerable number (about 33%) said that they were least confident (See Table 2). The results appear to run parallel to an earlier study carried out by Rosli Talif and Ain Nadzimah (2002) on trained teachers of Mathematics and Science. They concluded that "...the respondents have the necessary knowledge of the subject matter and are able to handle the demands of the curriculum. However, they are not confident to teach the subjects in English."

Although the MST expressed a lack of confidence in teaching Mathematics and Science in English, most of them, however, professed that they like to learn English (See Table 3). The MST also indicated that they were encouraged by their families and friends to learn the language. This reflects a social outlook toward the use of English that is positive not only among the MST but also in the society at large.

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Table 3: Attitude Towards English

	<b>Attitude Towards English</b>	0	1	2	3	4
1	I like English.	-	2.3	20.9	58.1	18.6
2.	1 like learning English.	-	2.3	18.6	55.8	23.3
3.	My parents encourage me to learn English.	7	7	20.9	51.2	14.0
4.	My friends encourage me to learn English.	4.7	7.0	34.9	46.5	7.0

A question was also asked as to whether they felt pressured about having to teach Mathematics and Science in English. To this, about a third of the MST replied in the affirmative, while a considerable number (62%) said otherwise (See Table 4). Another question focused on the need for help from an English teacher to assist them in the teaching of Mathematics and Science in English. Slightly more than half of the total of the MST (54%) said they definitely do, while 30% of them stated some help is necessary.

Table 4: Pressure in Teaching English

	<b>Pressure in Teaching English</b>	0	1	2	3	4
1	I feel pressured when I have to teach Mathematics and Science in English.	3.5	21	40.7	22.1	12.8
2.	I will need help from the English language teacher when I teach Mathematics and Science in school.	-	16.3	30.2	27.9	25.6

The survey also indicated a mixed response about their state of preparation to teach Mathematics and Science in English. Thirty-seven per cent of them felt that they were adequately trained while 33% responded in the negative, with 30% of them agreeing partially (See Table 5). The pattern of the response could be traced to their language proficiency and the language courses that they had to take as an undergraduate. The MST's SPM English grades ranged from grades 2-7. Thirty-five per cent had grades that fell within the range of grades 2 to 4 while the remainder (65%) had grades that ranged from grades 5 to 7.

Their perceptions of their ability to use English could also be reflected in their responses to the question as to whether English courses in UPM has helped them to be ready to teach in English. Forty-nine per cent of them agreed in the affirmative while the other 49% were not too sure.

Table 5: Adequate Training

<b>Adequate Training</b>		0	1	2	3	4
1	1 have been adequately prepared by my training programme to teach Mathematics and Science in English.	-	32.6	30.2	34.9	2.3
2	UPM English courses have prepared me adequately for the teaching of Mathematics and Science	2.3	18.6	30.2	39.5	9.3

Attempts were also made to situate language use in terms of language exposure. From the questionnaire, it was revealed that about 40% of the MST did not have much exposure to English for Mathematics and Science during their matriculation training and only 28% of the MST said that they have to read a lot in English to complete their assignments in the university (See Table 6). When it came to the presence of a supportive environment for the use of the language, it was found that only 6% of them said that English was widely used by their lecturers to teach Mathematics and

Science. Nonetheless, these MST (about 68%) felt that having to teach Mathematics and Science in English will help them to improve their use of the language.

Table 6: Exposure Towards English

	<b>Exposure Towards English</b>	0	1	2	3	4
1	1 have been well-exposed to English for Science during my matriculation training.	9.3	39.5	27.9	20.9	2.3
2.	1 read a lot in English for my undergraduate work in the university.	-	37.2	34.9	23.3	4.7
3.	My lecturers use a lot of English in teaching Mathematics and Science.	9.3	29	26	29	5.6
4.	Teaching Mathematics and Science in English will help me to upgrade my English proficiency.	2.3	12.8	17.5	45.3	22.6

At the same time, a high level of motivation is not apparent among the MST to learn English. Those who agree more strongly about being motivated is only 42%. The low level of motivation was further evidenced in the poor attendance of the MST in the Intensive English classes. The low motivation could further be compounded by their perception that proficiency in English will not affect career prospects. Only 14% felt very strongly that English is important for promotion (See Table 7).

Table 7: Level of Motivation/Perception of Importance of English

	<b>Level of Motivation/Perception of Importance of English</b>	0	1	2	3	4
1	I am highly motivated to learn English to teach Mathematics and Science.	4.7	14.0	39.5	25.6	16.3
2.	I believe that having a high proficiency in English will help in promotion	-	2.3	34.9	48.8	14.0

As Malaysians, the MST (65%) felt that they should be more proficient in Bahasa Malaysia though they were confident that being proficient in English would not make them any less Malaysian. The importance and use of Bahasa Malaysia is unlikely to be

overshadowed by the use of English in the near future. This affirms that the worry about the loss of identity and the lesser importance of Bahasa Malaysia as the national language is unfounded. In fact, only 16.3% of the MST felt that there is a need for more subjects to be taught in English.

Table 8: Attitude Towards Bahasa Malaysia

<b>Attitude Towards Bahasa Malaysia</b>		0	1	2	3	4
1	To be a Malaysian, I have to be more proficient in Bahasa Malaysia than in English.	2.3	4.7	27.9	39.5	25.6
2	Being proficient in English does not make me less of a Malaysian.	2.3	-	9.3	53.5	34.9
3	I believe that the importance and use of Bahasa Malaysia will not be over shadowed by the importance and use of English in Malaysia.	-	2.3	32.6	44.2	20.9
4	More subjects should be taught in English in school.	2.3	16.3	41.9	23.3	16.3

On the whole, 70% of the MST do consider themselves to be agents of change. They will encourage their students to use English in class and they also felt strongly that students could improve in their English in the Mathematics and Science classes. In terms of code-switching (Table 9), many of them believe that they would resort to the use of Bahasa Malaysia if they have difficulties explaining in English. However, very few of the MST (7%) considered themselves as efficient bilinguals. A large percentage (56%) was not sure.

Table 9: Agent of Change/ Attitude Towards Code Switching

	<b>Agent of Change/ Attitude Towards Code Switching</b>	0	1	2	3	4
1	I will encourage my students to use English when I teach Mathematics and Science.	-	4.7	25.6	46.5	23.3
2.	Students will improve their English when they learn Mathematics and Science in English.	1.1	1.1	16.3	45.5	35.5
3.	I will resort to the use of BM if I have difficulties when I teach Mathematics and Science in English.	11.6	20.9	46.5	20.9	16.3

Readiness to teach and the ability to assess using English in both subjects was also evaluated. As the policy change was recent, not many of these MST (30%) reported that they had an inkling of having to use English in their teaching. Only about 43% said that they were quite ready to set test questions in English for both the subjects. As teachers of Mathematics and Science, these MST are likely to need specific language skills to teach the subjects. These skills such as classifying, comparing, and defining are identified and when they were asked to rate their ability to use these skills, many of them (about 60%) viewed themselves as only having an average ability.

### **Discussion and Conclusions**

In context of the policy change, these stakeholders appear supportive of the move to acquire a better proficiency of the language through the teaching of Mathematics and Science in English. However, their level of motivation is not rated as very high although their perception about the use of English in class is positive. Most of the MST did not report on experiencing intense pressure to having to teach in English. Although the MST expressed some apprehensions such as not being able to set test questions and being under exposed to the use of English, they generally felt that they do not foresee major problems in their 'new' role.

An investigation by Ain Nadzimah and Chan (2003), reveals a state of peaceful coexistence between Bahasa Malaysia and English. The responses indicated that the goals for a national language to forge a national identity remains firmly rooted and the investigation concluded "... there is an undisputed pride toward the national language and a clear recognition accorded to the value of knowing the lingua franca of the world (English)" ( p. 88). Our present study reaffirms a dual language environment in which contentious competition between languages is absent.

The change experienced, essentially, is top down, and its sustainability is very much attributed to political will and determination. This is particularly pertinent as undue promotion of the use of English may be viewed with suspicion by the society at large. While there may be peaceful coexistence in the present status quo, changes in language education may still bring forth many sentiments and sensitivities related to identity, power relations, economic advantage and ideology. These grounds need to be treaded on gently.

With the policy change, the ancillary programmes such as manpower training, material preparation, and awareness of the teachers' needs and problems warrant attention. Momentous impact is on the end-user, who is the learner, on whose shoulders final success of the policy change is judged. Meanwhile, the strengths, and weaknesses of programmes, type and nature of resources, social forces and the processes involved in the realization of an "educated" Malaysian (equipped with scientific knowledge and the desired abilities, including having a language advantage and a global outlook), would need to be constantly monitored as the change becomes routinised and finally institutionalised. (terms used by Fullen and Stiegelbauer, 1991)

For long term planning of the English course to train MST, it is felt that materials ought to be specifically prepared and there should be continuity in its use. A point of reference could be the existing curriculum for Science and Technology that had been recently implemented. Tertiary institutions could form their action groups in arriving at common goals and objectives.

The issues that could be addressed are course duration, number of credits, status of such courses, as to whether they are part of the curriculum or out of the curriculum and material design and assessment of the students' mastery. All these factors would have a major impact on the success of the programme. In addition, what are the other roles that the universities can perform to give further support to the post learning of English among the MST who would then have become trained teachers? Can the universities provide self-access materials for the teachers, and is there a possibility of developing online services in the teaching of 'Mathematics and Science so that information can be accessed more widely?

Tertiary institutions often have little collaboration with efforts made in the ministry and other institutions. Could there be explorations to maximize resources and avoid duplication in work carried out? These are just some of the questions that could invite discussion.

To conclude, an echo of what has been said by Wong and Gwee way back in 1971 seemed to be relevant for success of the present policy change: "To meet the challenge ahead, Malaysia...will have to depend primarily on five elements: an education policy that is acceptable to all and yet flexible enough to meet the rapidly changing conditions, an efficient administrative pattern, a sound teacher training programme, a corps of enlightened administrators and supervisors, and a well coordinated research, planning and evaluation set-up" (p. 168). To add on, political will and determination and a heightened state of self-motivation on the part of the learners, we believe, are also necessary ingredients.

## References

Ain Nadzimah Abdullah and Chan, S. H. (2003) **Examining the use of English** within a dominant National language setting. In *Studies in Foreign Language Education*. No. 18, 73-90.

Asmah Hj. Omar and Noor Ein Mohd. Noor, (Eds.)(1 98 1). *National Language as medium of instruction*. Kuala Lumpur: Dewan Bahasa dan Pustaka.

Asmah Hj. Omar, ( 2003). Redefining the Role of English in Malaysia. In *Studies in Foreign Language Education*. No. 18, 1-16.

Ho, W.K. and Wong, R.Y.L. (Eds.) (2003). *English language teaching in East Asia today*. Singapore: Eastern University Press.



Fullen, M. G-& Stiegelbauer, S. (1991). *The new meaning of educational change*. New York: Teachers College Press

Rosli Talif & Ain Nadzimah Abdullah. (2002). *Investigating teacher concern: Science and Mathematics in English*. Paper presented at International Conference on English Language and Development for Equity in the 21<sup>st</sup> century, 24-26 September, 2002, Kuala Lumpur organised by The International Languages Teacher Training Institute (113PA).

*The New Straits Times*, February 6, 2001.

Tollefson, J. W. (ed.) 2002. *Language Policies in Education*. London: Lawrence Erlbaum Associates.

Wong, F and Gwee, Y.H..(1972). *Perspectives: The development of education in Malaysia and Singapore*. Kuala Lumpur: Heinemann Educational Books.



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