

Mathematics and Science in English – Teacher Voices

Ambigapathy Pandian and Revathi Ramiah

Universiti Sains Malaysia

Ambigapathy Pandian is an Associate Professor and Deputy Dean (Research and Post-Graduate Studies) at the School of Humanities, Universiti Sains Malaysia.

He is also head of the International Literacy Research Unit (USM-RMIT, Australia).

He has researched and published widely in English and Malay literacy in Malaysia.

and

Revathi Ramiah is a teacher and is currently pursuing her doctorate in English at the School of Humanities, Universiti Sains Malaysia.

She has been a trainer and resource person in Selangor and Perak.

Her main research interest is related to EAP and ELT methodology.

ABSTRACT

Beginning 2003 English was re-adopted as the medium of instruction for science and mathematics after 33 years of using Bahasa Melayu. This change may affect the dynamics of teaching and learning science and mathematics in the classroom. The Ministry of Education with the support of ELTC is providing training in English for the teachers concerned. While this is a proactive step in the right direction, it is also important to understand the teachers' views on the impact of this curricular change. Equally vital is the teachers' actual practice in using English outside the classroom, especially their reading behaviour as this is closely related to language development.

This paper reports findings from a recent survey among teachers currently teaching science and mathematics in selected schools in Perak. Two sets of questionnaires were used as instruments to:

- a) elicit their views on this change*
- b) to understand their actual reading behaviour*

In order to cross validate these findings, selected teachers were also interviewed.

Introduction

In January 2003 Malaysia took a bold step in re-adopting the English language as a medium of instruction for science and mathematics. This change in policy was deemed necessary to ensure that Malaysians are able



to keep abreast with scientific and technological development that is mostly recorded in the English language. At the same time, this move is envisaged to provide opportunities for students to use the English Language and therefore increase their proficiency in the language (Sharifah Maimunah Syed Zin, 2002).

This change in policy is congruent to significant developments and understandings in second language acquisition that emphasises the role of meaningful, understandable input (Krashen, 1981). In this case, teaching mathematics and science in English provides a rich context for genuine language use and as such serves as a focal point around which oral language and literacy in English can develop (Kessler & Quinn, 1987). Whilst this move may be seen as desirable and progressive, it is one that changes the dynamics of teaching and learning mathematics and science in the Malaysian classroom.

Teachers and students who have been teaching and learning in Bahasa Melayu are now expected to perform effectively in English, to teach and acquire subject specific knowledge. This is indeed a formidable challenge, seen in the light of concerns voiced about English teachers' proficiency and competency (Pillay, 1998) and the overall declining standards of English (Pillay 1998, Ambigapathy, 2001). On one hand we have students who must learn math and science content while they are still learning English (McKeon, 1994) and on the other, we have teachers, who themselves have proficiency problems with the new medium of instruction. When the competency of English teachers themselves becomes questionable, what more can we expect of teachers of mathematics and science? These teachers who are not language specialists will have to cope with the double demand of transmitting content as well as language. Will they be able to cover their subject area in an accurate and effective manner?

Therefore to understand the task at hand, it is important for us to understand the perceptions, knowledge, attitudes and readiness of these teachers towards the teaching of mathematics and science in English. As

Ambigapathy(2002) asserts, what teachers know and can do, affect all the core tasks of teaching. Furthermore, numerous studies (Gambrell, 1996; Chakravarthy, 1997; Ambigapathy, 1999) have stressed the roles of teachers in influencing the behaviour of students. With this in mind, the purpose of this study is to investigate:

- 1) -the reaction of these teachers to using English as the medium of instruction
- 2) -problems encountered by these teachers in using English in the classroom
- 3) -teachers' awareness of the nature of mathematical and scientific discourse
- 4) - availability of language support systems
- 5) - teachers' attitudes towards reading in English

Research Design

This study sought to obtain some feedback from teachers teaching mathematics and science in Form One, in respect to the change in the medium of instruction.

Instruments

Two questionnaires were used in this study (Questionnaire A and B). Questionnaire A consists of two sections. Section A solicits selected personal background information of subjects and section B comprises of twenty-four statements related to teacher views and teaching practices. The choice of answers was given on a Likert scale.

Questionnaire B solicits information based on subjects' reading attitude. This questionnaire comprises of 20 items translated from the 5 stages of positive reading attitudes based on Krathwohl's (1964) affective domain taxonomy.

Semi-structured interviews were also conducted on a smaller sample of respondents for cross-validation purposes.

Subjects

Eighty-eight teachers currently teaching Mathematics and Science in Form One were invited to participate in the study . These teachers come from sixteen schools (urban, semi-urban and rural) situated in one district in Perak. The subjects comprised of thirty-two (32) male and fifty-six (56) female teachers. This figure is quite reflective of actual gender ratios in the teaching profession in Malaysia.

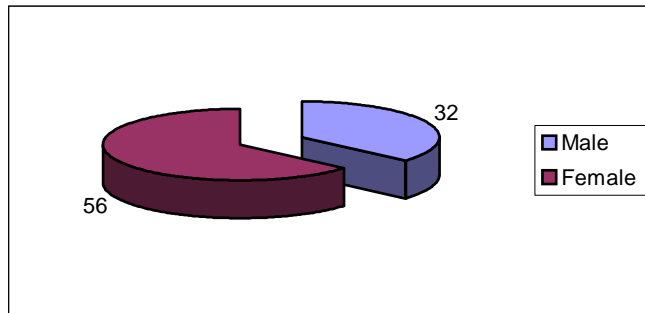


Figure 1: Gender Composition of Sample Population

In terms of ethnicity, there were fifty-two (52) Malays, thirty (30) Chinese and six (6) Indians (Figure 2). All eighty-eight subjects responded to Questionnaire A. However, only seventy-seven (77) subjects responded to Questionnaire B.

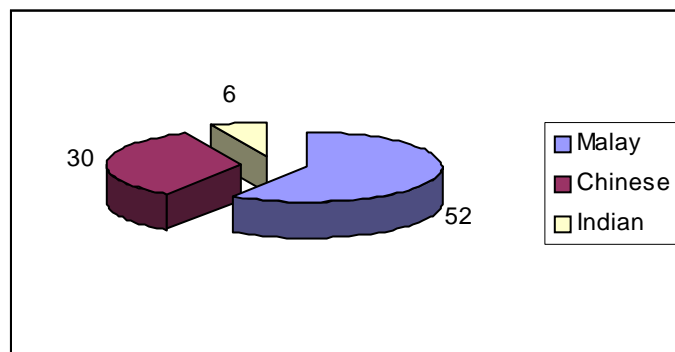


Figure 2: Ethnic Composition of Sample Population.

Data Analysis

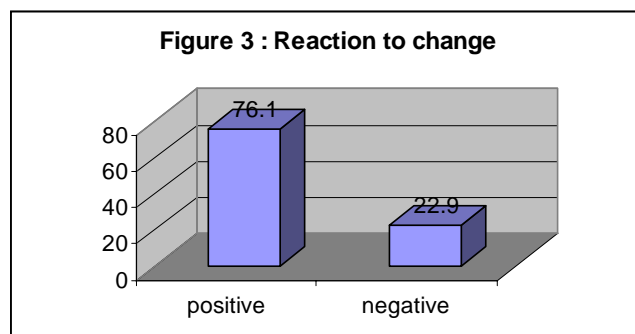
The subjects' responses are analysed using descriptive statistics. Percentages and frequencies of their responses to the items related to their reaction to the change in the medium of instruction, the problems encountered in terms of the use of English in the classroom, their awareness of scientific and mathematical discourse and the support available to them were calculated. The same applies to their responses to the questionnaire on reading attitudes.

Survey Findings

Reaction to the change in the medium of instruction.

It was found that 76.1% of the respondents felt that the move to switch to English as the medium of instruction was timely and necessary. These respondents cited the fact that scientific and technological knowledge is in English and therefore it is important to acquire the necessary language skills to access this information. 22.9% did not agree with the move and the main reason given was the fact that their students were not proficient in English and as such are not able to follow the lessons in class.

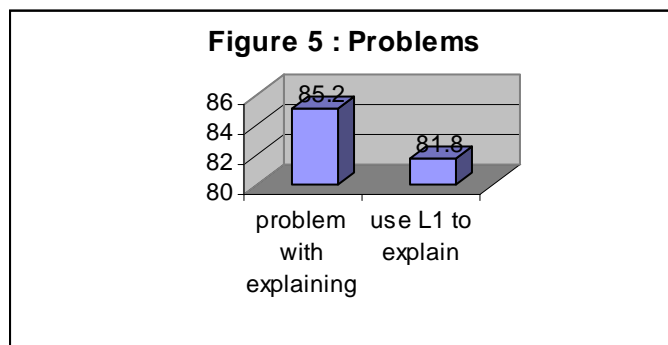
When the announcement regarding the policy was made, 46.6 % of the subjects indicated shock and feelings of inadequacy in coping with the task but 75.0% indicated that they were confident of coping with the change after attending the ETeMS course organised by the Ministry of Education. However, only 38.6% indicated that the ETeMS course was sufficient to enable them to teach in English and 43.2% felt that they still lack the necessary language skills.



Problems encountered in the classroom.

It was found that the main problem encountered by teachers was in explaining concepts in English. 85.2% of the respondents indicated that they had problems explaining concepts in English and 81.8% admitted to using Bahasa Melayu (L1) to give explanations when faced with a breakdown in communication when using English.

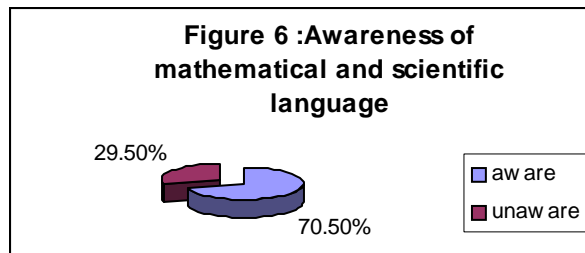
Other problems mentioned by the respondents interviewed were related to the textbook and multimedia courseware provided by the ministry. The textbook was said to be too brief with inadequate examples and descriptions and thus was not very useful, especially for LEP (Low English Proficiency) students. The multimedia courseware was also said to be unsuitable for LEP students as they were not able to understand the language used to deliver the content.



Awareness of scientific and mathematical discourse

Subjects such as mathematics and science use academic language, which has its own register, syntax, semantic properties and discourse features. These texts are also different from general English as they lack redundancy, are conceptually packed and contain symbols, charts and graphs. It was found that 70.5% of the respondents indicated that there was a difference between general English and the language of mathematics and science. 93.2% of the respondents also indicated that it was the duty of the mathematics or science teacher to teach “the language of math and science”

to their students. 90.9% of the respondents felt that mathematics and science teachers should guide students to understand and use graphics that are normally found in mathematical and scientific text. However, interviews with the respondents revealed that these teachers are not clear about the linguistic features of their content subject. Therefore, these teachers are unable to help their students to cope with academic language.



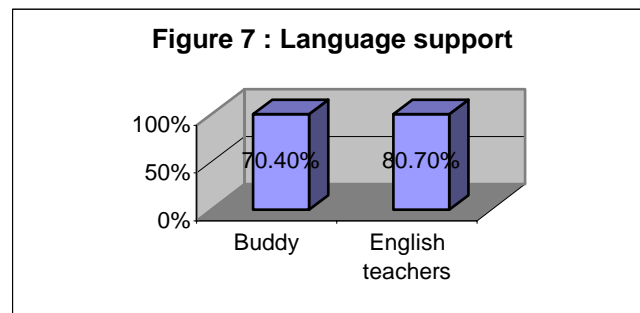
Availability of language support

Apart from the ETeMS course, teachers of mathematics and science are supposed to get language support from the “buddy system” whereby they can get help from identified resource persons in their respective schools. It was found that 70.4% of the respondents indicated that they have language support from the “Buddy” and “Critical friend” assigned to help them. Interviews with respondents revealed that “help” in this sense meant assistance mainly with vocabulary and grammar. Respondents also indicated that they were unable to use self-learning materials such as the multimedia materials and grammar books provided by the ministry due to lack of time because of heavy teaching and administrative workloads.

In terms of language support from the English panel, 80.7% of the respondents indicated that their English counterparts provided assistance. Interviews with the respondents disclosed that this assistance was mainly with vocabulary and grammar. 76.2% of the respondents also indicated that they often discussed language problems related to the teaching of mathematics or science with their English counterparts. 73.8% of the respondents felt that the English Panel is equally responsible in facilitating the change in the medium of instruction. According to the respondents the English Panel contributes by having programmes such as ‘Learn a word a day’ to improve general proficiency.

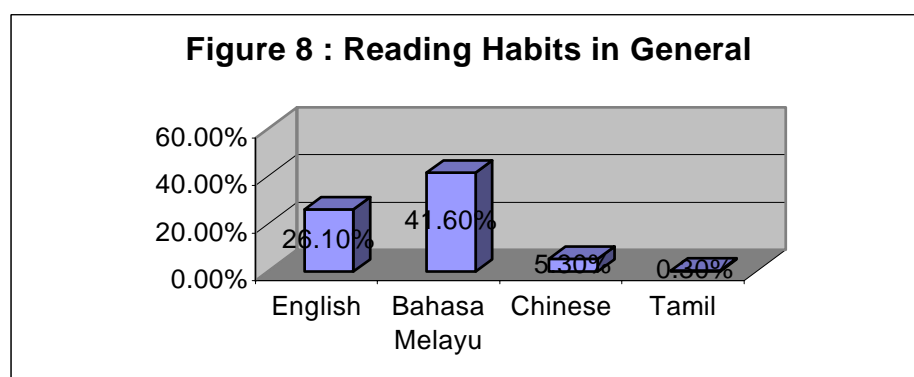
In terms of collaborative teaching between the mathematics and science teachers with their English counterparts, 36.4% of the respondents claimed that they do collaborate with their colleagues. However, the interview with respondents revealed that 'collaboration' in this sense meant using their English counterparts as a source of reference when they have difficulties with grammar or vocabulary.

It was found that 87.5% of the respondents felt that the multimedia courseware supplied by the ministry to teach science and mathematics is well-planned and effective in terms of content. However, respondents who were interviewed claimed that the language used in these materials was more suitable for proficient students. Most respondents maintained that LEP students had trouble following the content presented because of language difficulties.



Reading attitudes.

Reading is an important component of language development. It was found that only 26.1% of the respondents read habitually in English. 41.6% of the respondents read in Bahasa Melayu, 5.3% read in Chinese and 0.3% read in Tamil. In this case, percentages for reading in Chinese and Tamil are significantly lower due to low sample population. 59.5% of the respondents



read in English if they are required to do so and 42.7% of the respondents appreciate reading in English and attempt to do so if possible.

Summary of Findings and Discussion

The findings of this study reveal that teachers of mathematics and science;

1. are generally perceptive of the change in the medium of instruction.
2. still require a sustained language input programme for their own language development.
3. are prone to using Bahasa Melayu (L1) when faced with difficulty in explaining concepts to their students.
4. require content materials that are more suited for LEP students.
5. are generally aware of scientific and mathematical discourse but are unable to communicate the linguistic elements of this form of discourse to their students.
6. need intensive language support to help them deal with LEP students.
7. must cultivate better reading habits in English to sustain their own language development.

The purpose of introducing English as the medium of instruction in the teaching and learning of science is mainly to enable students to keep up with the developments in science and technology by making it possible for them to access this information which is mostly available in the English language. Teachers of science and mathematics generally understand this need and are trying to facilitate this move. However, some of these teachers feel that they themselves lack the necessary language skills to teach in English. The ETeMS programme that was introduced by the ministry is only an urgent interim measure to ensure that these teachers have some basic capacity to use English as the medium of instruction (ETeMS Module, Facilitators Notes, 2002). Therefore, there is obviously a need for sustained content specific language input for the personal language development of these teachers. As these teachers play a vital role in modeling good language practices in their classrooms, it then becomes crucial for them to master the language elements of their content subject. Furthermore as findings of this study demonstrate that these teachers literacy activities in English is

generally low, they must take the initiative to develop their language proficiency by reading in English.

In terms of language problems in the classroom, it is alarming to note that 81.8% of the respondents studied used the L1 (Bahasa Melayu) to explain concepts when students faced problems in understanding these concepts in English. While it is necessary to some extent to draw upon background understanding and literacy in the first language, it is dangerous to rely on the L1 as a crutch. As Bowering (2003) points out limited use of Bahasa Melayu in the classroom will be of great benefit in helping students meet the challenge presented by English but total translation as an easy way out defeats the purpose of teaching these subjects in English. Instead these teachers should be exposed to alternative instructional approaches such as the 'Sheltered English Instruction' method. In this approach content teachers use simpler English and a wide range of scaffolding strategies to communicate meaningful input to their students. In this manner the content taught is expressed to suit the proficiency level of their students. Perhaps it is time for these teachers to recognise that subjects such as science should be viewed as an active process of developing ideas, rather than as a static body of already-existing knowledge to be passed on to students (Main & Eggen, 1991). If teachers and policy makers are able to adopt a more progressive view of teaching and assessing, it will definitely be possible to accomplish the task at hand.

Other problems mentioned by the teachers are related to the prescribed textbook and the multimedia courseware supplied by the ministry. As Mohan (1990) points out that in many content classes reading a textbook is the main means of studying the content to be learned. Mohan also further explains that students' success in understanding their textbook is dependent on two factors - the content factor and the language factor. Mohan maintains that the language factor, is actually knowledge that is related to the formal organisational structures of different types of texts. This knowledge of text types actually falls within the domain of the language teacher. Thus successful reading of content textbooks is actually dependent on having



content knowledge and knowledge of text types. Therefore to facilitate successful reading among LEP students, joint action by the content and language teachers is required.

Accordingly, joint action is the kind of collaboration that is required to ensure success in using English as the medium of instruction. In order to help LEP students to overcome linguistic barriers in the course of learning content, the language teacher together with the content teacher must assess the needs and required language skills of these students (Dale and Cuevas, 1987). Of course this sort of action requires extended time and effort on the part of the teachers and thus may not be practicable in our present school context. However, governing curricula bodies such as the Curriculum Development Centre or joint working-committees at district or state levels could look into this suggestion.

Conclusion

The findings of this study suggest that generally teachers of mathematics and science recognise the need for the change in the medium of instruction. However, the prevailing language support mechanisms do not meet their needs. The problem here is multi-faceted and therefore not only related to mathematics and science educators and curriculum developers. Language educators – English teachers need to re-think their role and the immediate needs of the students that they teach, as pointed out by Prof Dr Saran Kaur Gill,

Language educators play a pivotal role in implementing this far-reaching policy decision. In this context, it is essential that they understand and are able to look at the bigger picture.

Star, March 30, 2003

While it is not practical to exclusively devote classroom time to teaching content-based language, it is important that English teachers learn how to integrate academic language that is related to content in their classrooms (Crandall, 1992).

Efforts must be made to encourage joint action between teachers of mathematics and science with their language counterparts. However, efforts such as these require in-service teacher education to ensure that mathematics and science teachers have some basic understanding of second language acquisition while language teachers need to be exposed to basic processes in mathematical and scientific enquiry. At the same time these factors should also be taken into account in preparing would-be teachers of mathematics, science and language.

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