

Preservice Teachers' Anxieties in Using English to Teach Mathematics: An Exploratory Case Study

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ABSTRACT

In line with the national policy to use English as the medium of instruction, the training of preservice teachers in the teachers colleges have also begun to use English in teaching mathematics. This preliminary case study explored the anxieties of a group of 20 graduate preservice mathematics majors as they prepared to teach the mathematics in English. Data was collected through an open-ended essay written by the preservice teachers about their feelings toward teaching mathematics using English. This was done in the context of a minor course in Additional Mathematics where the participants were required to prepare lesson plans and carry out the plans during microteaching. An interpretative approach was used to analyse the data. Initial findings show that although the preservice teachers' main anxieties concerned the use of English as the medium of instruction, the teachers were also anxious about how mathematical meaning was constructed.

INTRODUCTION

The problems and difficulties in the teaching of mathematics using English as the medium of instruction beginning 2003 seem similar to that faced by teachers during the implementation of the new mathematics curriculum in the 1970's. In attempting to implement the new mathematics curriculum then, the teachers were faced with two main challenges (Lee, 1982). First the teachers had to cope with the new content of mathematics. There were new topics in the syllabus namely matrices, probability, statistics, inequalities, transformations and vectors. Secondly, the teachers had to cope with the change in the medium of instruction from English to *Bahasa* Malaysia.

As was noted by Austin and Howson (1979), the issue of bilingualism is to a considerable extent a political matter. Nonetheless this debate on the issue of the use of English seems to have abated. However the change in the medium of instruction to English has given rise to questions concerning the difficulties the mathematics teachers might face. Yet the main challenge is not to debate whether our teachers are capable of handling the task but rather on ways of assisting the teachers in the teaching and learning of mathematics. Therefore one immediate task is to look into the difficulties and problems that confront the teacher of mathematics.

This exploratory study focuses on a group of preservice teachers who had completed their entire education in mathematics both in schools and higher institutions of learning using *Bahasa* Malaysia as the medium of instruction. In particular the study aims to understand the preservice teachers' feelings toward the teaching of mathematics in English.

RELATED LITERATURE

Language and Concept Formation

Skemp (1989) theorised that mathematical concepts were constructed via three modes: through experience from one's own encounters with the physical world, through communication with others and through creativity when one starts to construct higher-order concepts by extrapolation, imagination and intuition. It is seen that language plays an important role in each of these modes of concept formation. Although there is a possibility that concepts can also be formed without the use of language, this is only possible in lower-order concepts that are less abstract. In contrast, higher-order concepts are formed when one moves further away from direct sensory experience and would therefore be more embedded in language.

In studying the development of thought and speech, Vygotsky (1934/1962) theorised that language occupied an integral part of thought. He argued that although the development of thought and speech were not always parallel, the onset of speech at about age of two initiates new forms of thinking. Vygotsky (1934/1962) further argued that "the new significative use of the word, its use as a means of concept formation, is the immediate psychological cause of the radical change in the intellectual process that occurs on the threshold of adolescence" (p. 108). Bruner (1966) even went on further to say that thought would eventually conform to language. Mathematical concepts, which form part of mathematical thought, are therefore intertwined with language.

Language Related Difficulties in Teaching and Learning Mathematics

Mathematics has been observed to be a language that operates on its own symbols and conventions. There have been several studies that looked into language-related difficulties in the teaching and learning of mathematics. Even among children who are proficient in the English language, there exist language-related difficulties. Lexical problems exist in mathematics (Durkin & Shire, 1991). This is especially so since many mathematical terms also appear in everyday language. Mathematical terms like 'simple interest', 'pie chart', 'square root' and 'closed figure' all contain words that carry different meanings in the everyday context. This gives rise to ambiguity as the learner attempts to grapple with the mathematical meaning of the words. For example, Durkin and Shire (1991) reported the case of a boy whom when asked the mathematical meaning of the word 'volume', said that it was a knob on the radio.

Solving word problems is also another area of concern in learning mathematics. Even elementary arithmetic word problems present difficulties to learners. For example, the simple addition operation can appear in three different semantic forms in word problems: *Change problems* - Ali has three durians, Ahmad gave him four more. How many does Ali have now?, *combine problems* - Siti has 3 pencils. Haliza has 4 pencils. How many do they have altogether?, and *compare problems* - Ah Chong has 3 pencils. Ah Kow has 4 pencils more than Ah Chong. How many pencils does Ah Chong have? (De Corte & Verschaffel, 1991). Word problems that can be solved using the same arithmetic operation but worded in different semantic forms not only present different levels of difficulty, but result in children using varying strategies to solve them (De Corte & Verschaffel, 1991). The semantics of the language is consequently seen as one major cause of children's difficulties in solving word problems.

Learning mathematics in a second language. Learners whose mother tongue is not the language of instruction can be expected to face difficulties in learning mathematics because of

their limited proficiency in the language. Clarkson (1991) researched into the various types of errors found in year five Papua New Guinea students when they solved word problems in English which was the language of instruction but was not their mother tongue. Clarkson found that 39% of the errors committed were in reading and comprehension and concluded that their difficulties were due to their limited mathematical vocabulary.

Lim and Chan (1993) conducted a study to determine the mathematics achievement of year six Malay pupils attending SK schools that used *Bahasa Malaysia* as the medium of instruction and SRJKC schools that used Chinese as the medium of instruction. Three tests were used. The first test was used to test for understanding of basic mathematics concepts; the second to test for computational skills while the third tested the students on their ability to solve word problems. The results of the study showed that the Malay pupils of the SRJKC schools performed better only in test 2, showing that they were better in computational skills. However they lacked behind their counterparts from the SK schools in test 1 and test 3 showing that they were weak in understanding of mathematical concepts and the ability to solve word problems. Both these areas were related to their ability to understand Chinese, which was the medium of instruction in the SRJKC schools. This therefore showed a possibility that their weakness in the language could be the cause of their difficulties in understanding mathematical concepts and solving word problems.

While there is evidence that the lack of language proficiency could pose as a constraint in learning mathematics, there are other mathematics educators who suggest that “students are capable of learning advanced mathematics whether or not they are fluent in English and whether or not their teacher can speak their native tongue” (Secada & Carey, 1993; p. 1). Secada and Carey (1993) also suggested that instruction should focus on students’ understanding to prevent misconceptions as well as students’ thought processes during problem solving.

Education today emphasises mathematics as communication (National Council of Teachers of Mathematics, 1991). In Malaysia too, mathematics teachers are encouraged to place importance on mathematical communication in its various forms: verbal, written and symbolic (Kementerian Pendidikan Malaysia, 2001). It is seen that proficiency in the language of instruction influences the learning of mathematics since language is the basis of communication. However communication in mathematics does not focus only on the language of instruction but rather on the language of mathematics. The content of this communication is mathematics while it’s medium is the language. As was theorised by Olivares (1996), there exist the two main fundamental components in mathematical language proficiency: the communicative competence in mathematics and, the mathematical knowledge and behaviours of the discipline. Concentrating of the language aspect alone would be insufficient to enable to children to communicate mathematically. To be able to communicate mathematics effectively one would be required to have the basic language skills and also the necessary mathematical skills and knowledge of the mathematical concepts. Moreover the teacher would need to create a suitable context where the student can communicate and inquire into the mathematics of the task at hand (Richards, 1991).

THE STUDY

The main purpose of this study is to explore the feelings of a group of preservice teachers about the teaching of mathematics in English.

The Context of the Study

The focus group. The focus group consisted of 20 graduate (17 females and 3 male) preservice mathematics majors learning to teach in a teachers college. All of the participants had just graduated from local universities in 2002.

The teacher training course. As part of the course requirements, the participants were required to take credits in an education component, the mathematics component and a minor course in additional mathematics. Data were collected while the participants were undergoing the minor course in Additional Mathematics and the researcher was the lecturer of the course, which was conducted in English. The Additional Mathematics course emphasised content as well as pedagogy. There were no standard examinations in the course. Assessment was done through two assignments. The first required the teachers to search the web and write on ways to incorporate ICT in the teaching of mathematics. In the second assignment, the teachers who worked in pairs were required to plan a lesson on an Additional Mathematics topic and carry out the lesson in microteaching where their peers played the role of school pupils.

The Additional Mathematics course started in August 2002 and ran for ten weeks (two hours a week) before the semester holidays began in November 2002. During this ten-week period, interaction was centred on classroom lectures and microteaching. Interactions resumed in January 2003 and were mainly carried out in the form of classroom lectures that were focused on preparing the teachers to teach Additional Mathematics in schools. The lectures were content-based, emphasising the teaching of mathematical concepts and procedures.

Data Collection

Various forms of data were collected. The main portion of data was collected in the form of an open-ended essay that the teachers wrote in the beginning of February 2003 where the teachers were asked to write about their feelings concerning the teaching of mathematics in English. The participants had a free choice of writing the essay either in English or in Bahasa Malaysia. This was done so that the participants could freely articulate their feelings. Other information that was gathered included: the lesson plans that the teachers wrote for their assignment, pre and post reflections of the microteaching and videotaped recordings of the microteaching. Five microteaching sessions were videotaped. The rest were not taped due to the unavailability of the microteaching room, which had facilities from video recording. Researcher notes on the microteaching were also taken.

Data Analysis

For the purpose of this study, the findings were based primarily on the open-ended essays. The main method of analysis used was the traditional method of immersion. The open-ended essays of the teachers were analysed for statements that helped clarify the feelings and anxieties of the teachers. These statements were then typed and coded according to various categories and then filtered and grouped using the EXCEL programme.

Besides the open-ended essays, the other information that was gathered was also useful as it helped corroborate the findings of the study.

FINDINGS OF THE STUDY

Out of the 20 participants, only four chose to write their essays in English. The rest were written in *Bahasa* Malaysia. From the analysis of the data, two main groups of anxieties and difficulties emerged. Table 1 shows the categories together and the number of teachers who reported these difficulties, which gives a general idea of the frequency of each category.

English Language-Related Anxieties

The fact that sixteen of the participants chose to write the essays in *Bahasa* Malaysia indicated that the participants could better articulate their feelings in the language. The participants were most anxious and concerned about their fluency and their ability to communicate and present ideas in the English language. “I can’t speak English fluently”(Participant P1), “*Percakapan saya kurang lancar kerana kehilangan idea. Saya boleh menerima apabila seseorang itu berbahasa B.I. dengan saya tetapi cuma saya sukar membalas/bercakap dengannya dan tersekat-sekat* [My speech is not fluent because I loose ideas when I speak. I can accept when someone speaks to me in English but I find it difficult to reply and I do so haltingly.]” (P4) “*Ini kerana kadang-kadang saya hilang perkataan kerana sukar bertutur secara spontan.* [It’s because sometimes I am loss for words because I find it difficult to speak spontaneously].” (P9)

As was pointed out by one participant, this lack of fluency in the language is related to the lack of command of grammar and pronunciation. “*Semasa mikroteaching pula, saya kurang berkeyakinan menggunakan English language. Ayat yang berterabur. Grammar, pronunciation semuanya terabur.* [During microteaching I was not confident using English. The sentences were all simply used. The grammar and pronunciation were simply used.”(P18).

One participant was particularly anxious about her pronunciation. “*Saya mempunyai masalah pronoun dalam B.Inggeris. Walaupun saya membaca banyak buku-buku b.Inggeris saya masih mempunyai masalah menyebutnya. Saya berasa panik apabila saya tidak dapat menjelaskan sesuatu ataupun mengetahui penyebutan saya salah.* [I have problems in pronunciation. Although I read books in English, I still have problems in pronunciation. I would panic when I cannot explain or when I know I have pronounced wrongly.”(P3)

Mathematics Related Anxieties

Mathematics content. Twelve of the participants voiced their anxiety about looking for the right mathematical terms to use. “*Istilah-istilah matematik yang biasa belajar dalam bahasa Melayu memberi masalah kepada saya untuk diterjemahkan ke bahasa Inggeris* [I face problems in translating the mathematical terms I had learnt in *Bahasa* Malaysia] (P15). As was pointed out by one participant one worry of the participant was that using the wrong mathematics term would affect the meanings of the mathematics content. “*Lebih-lebih lagi, istilah yang digunakan.* [Moreover it’s in the terms that are used.] You know that the terminology in Mathematics is quite different with the normal English language. Well, if I used the wrong terminology it may affect a lot of the contents in the subject.” (P12). This highlights the fact that the use of the right mathematics terms is intertwined both in the language as well as in the mathematical concepts. One needs to know the right term in English as well as the mathematical meanings of the term.

Mathematics pedagogy. One anxiety that emerged from the study was their anxiety toward lesson planning and microteaching. This was the first time the participants were exposed to pedagogy. Subsequently it was also the first time they experience writing lesson plans.

“Dalam pembinaan RPH (*Rancangan Pengajaran Harian*) pula dari set induksi, langkah-langkah sehingga 'closure', disitulah kesukaran yang paling ketara yang menyebabkan saya pening kepala. [During the construction of the lesson plan from the set induction, the steps up to the closure, that was the most difficult and caused me to have a headache]” (P18).

This difficulty in writing lesson plans was further compounded since they had to write their lesson plans in English. “Datang lagi satu masalah yang menimpa... rupa-rupanya kalau nak mengajar pun kena ada plan. Jadi kita orang pun kena buat lesson plan... dalam bahasa Inggerislah ni. First lesson plan dalam bahasa Inggeris ambil masa sampai 2 hari. Bayangkan kalau dalam Bahasa Melayu kurang dari satu jam mampu siapkan. Masa terbuang banyak! [There was one more problem that had befallen me ... seems like even when we want to teach, we also need to plan. Therefore we had to write the lesson plan in English. My first lesson plan took 2 days. Imagine if it is in *Bahasa Melayu* it will take less than an hour to complete. I wasted a lot of time]” (P20).

Context-Related Anxieties

The anxieties in the teaching of mathematics in English in this research emerged in the context of the preservice teachers' lesson planning and microteaching. The role of the children in the microteaching classroom was played by their own peers. One anxiety that emerged in this context was related to the participants' emotion. Some of the participants felt shy when they had to teach in front of their peers and the lecturer in English. “Mungkin ada perasaan malu kut sebut sesuatu perkataan tu silap. [Maybe I felt shy when I did not pronounce a word right]” (P10). “Perasaan takut ditambah lagi dengan malu jika sebutan tersalah dan diketawakan oleh orang. [There was sense of anxiety and added to that a feeling shyness if I pronounced something wrong and others would laugh at me]” (P11). “Nervous, shy, not confident are the things came in my mind under your observation” (P12).

The two main causes of anxiety seemed related to the fact that the preservice teachers had to teach in front of their peers and lecturer in a second language, in which they had little confidence. Moreover it was a first-time situation for the teachers and this itself was the cause of some anxiety in the teachers.

Ways Used to Overcome Anxieties and Difficulties

The participants mentioned several ways they had used in order to help them cope with the anxieties. The most common was the use of dictionaries and mathematics terminology references. Six participants reported using the dictionaries for purposes of translation. “saya telah membeli 2 buku kamus. Kamus pertama adalah bagi terminologi matematik (inggeris) dan sebuah lagi juga kamus B.Inggeris - B.Malaysia. [I bought two dictionaries. The first was for mathematics terminology and also an English – *Bahasa Malaysia* dictionary]” (P3).

The participants also reported other ways they had used to help improve their proficiency in English. Five participants reported using various means to improve their English. One of the ways that was reported was by reading newspapers and novels. One participant even reported using commercially available audio tapes besides reading newspapers, novels and magazines. “Sekarang ini saya sedang berusaha untuk memperbaiki dan meningkatkan kemahiran Bahasa Inggeris dari segi pertuturan dan penulisan dengan mengikuti pengajaran menggunakan 'X-phone' dan membaca akhbar, novel dan majalah dalam bahasa Inggeris. [I am now working very hard to improve both my spoken and written English by following 'X-phone' lessons and by reading newspapers, novels and magazines in English.]”

Although the participants voiced their anxieties about the use of English in teaching mathematics, five of the participants said that they were confident that in time they will be able to adjust to the use of English in teaching mathematics. What they needed was time to improve their English proficiency. "I think there is no problem to study math in English but to teach math in English, it's take time but I know all of us can do it" (P2). "*Tapi dalam bahasa Inggeris as a 2nd language ini kebanyakan lecturer dan kawan-kawan cakap biar terukpun for the first time lama-lama akan jadi pandai.* [But in English as a second language most of the lecturers and my friends, although they might not be able to speak well for the first time, in time they will be proficient." Thus although the anxiety towards teaching mathematics in English can be seen in the participants, the participants expressed confidence that given time they will be able to use the language well to teach mathematics.

CONCLUSION AND DISCUSSION

While it is not possible to draw generalisations from this small exploratory study, a few key elements concerning about the preservice teachers' feelings towards the teaching of mathematics in English have emerged. First the teachers seemed anxious about their own English proficiency, in particular their fluency in speaking the language, the English grammar and pronunciation.

Moreover the teachers perceived that teaching mathematics in English would pose a bigger problem than learning mathematics in English. The teachers' opinions seem to imply they have the traditional expository view of teaching mathematics where teachers would be required to talk more, explaining and clarifying mathematical concepts and procedures.

The second key element that emerged was the teachers' anxiety in using the right mathematics terminology. The teachers were concerned about using the correct terminology in order to convey precisely the mathematical meanings of terms. The teachers were thus also concerned about the mathematical content they were to teach. For the teachers the right terminology ought to be used in order that it conveys the correct mathematical meaning.

These two key elements raise one issue concerning teacher education in Malaysia. While one main thrust of the mathematics curriculum is to promote mathematical communication (Kementerian Pendidikan Malaysia, 2001), these anxieties of the teachers would pose as constraints in encouraging mathematical communication. There is thus a need to minimise this anxiety in preservice teachers. Any strategy used should however address both the issues of language proficiency as well as competency in content and pedagogy. In the implementation of the teacher education curriculum, the preservice teachers should be provided with opportunities to communicate mathematically. Strategies such as problem solving activities, co-operative learning, group work and peer tutoring can be included so as to help the preservice teachers become more proficient in the academic language through listening, speaking, reading and writing. Allowing the teachers to communicate on the subject and to clarify their mathematical thinking can help develop language skills (Cuevas, 1984). The teacher education course should perhaps be tailored to help the preservice teachers overcome their anxieties by showing and discussing how to teach students the mathematical language that includes the unique terms, symbols, and expressions that occur in math discourse.

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APPENDIX A

Table 1.

The Categories of Teachers' Anxieties and Their Frequencies

Category of Teacher Anxiety	Number of Teachers
Fluency and difficulty in communication	13
Pronunciation	7
Grammar	5
Vocabulary	5
Terminology	12
Explaining concepts	6
Lesson planning	5
Emotion	7
Spontaneity	6