UNIVERSITI SAINS MALAYSIA

UNIVERSITY RESEARCH GRANT FINAL REPORT
Geran Penyelidikan Universiti Laporan Akhir

A.	**TITLE OF RESEARCH:** *Tajuk penyelidikan:* **Communication and Language used in Mathematics Classroom Discourse**
B.	**PERSONAL PARTICULARS OF RESEARCHER** / *MAKLUMAT PENYELIDIK:*
(i)	**Name of Research Leader:** *Nama Ketua Penyelidik:* **Prof Madya Lim Chap Sam**
	Name of Co-Researcher *Nama Penyelidik Bersama:* **1. Dr Chew Cheng Meng** **2. Dr Tan Kok Eng** **3. Dr Kor Liew Kee**
(ii)	**School/Institute/Centre/Unit :** *Pusat Pengajian /Institut/Pusat/Unit* : **Pusat Pengajian Ilmu Pendidikan**

C.	**Research Platform (Please tick (/) the appropriate box):** *Pelantar Penyelidikan (Sila tanda (/) kotak berkenaan):* ☐ **A. Life Sciences** *Sains Hayat* ☑ **B. Fundamental** *Fundamental* ☐ **C. Engineering & Technology** *Kejuruteraan & Teknologi* ☐ **D. Social Transformation** *Transformasi Sosial* ☐ **E. Information & Communications Technology (ICT)** *Teknologi Maklumat & Komunikasi* ☐ **F. Clinical Sciences** *Sains Klinikal* ☐ **G. Biomedical & Health Sciences** *Bioperubatan Sains Kesihatan*
D.	**Duration of this research :** *Tempoh masa penyelidikan ini :* ***Duration :** .....2 years and 8 months..... *Tempoh :* **From** : ... 22 / 10 / 2007.. **To** : ... 30 / 6 / 2010 *Dari:* *Ke :*

E. **ABSTRACT OF RESEARCH**

(An abstract of between 100 and 200 words must be prepared in **Bahasa Malaysia and in English.** This abstract will be included in the Annual Report of the Research and Innovation Section at a later date as a means of presenting the project findings of the researcher/s to the University and the community at large)

Abstrak Penyelidikan

(Perlu disediakan di antara 100 - 200 perkataan di dalam **Bahasa Malaysia dan juga Bahasa Ingge** Abstrak ini akan dimuatkan dalam Laporan Tahunan Bahagian Penyelidikan & Inovasi sebagai satu ca untuk menyampaikan dapatan projek tuan/puan kepada pihak Universiti & masyarakat luar).

This study addressed the urgent need to explore the kind of language(s) used by mathematics teachers and pupils in the Malaysian primary classrooms under the Teaching of Mathematics and Science in English [PPSMI] language policy. A comparison of the language use by expert and novice mathematics teachers; and by good and weak class pupils from three types of primary schools was done. Qualitative data were collected comprising 12 video-taped mathematics lessons and in-depth interviews with six mathematics teachers and 10 of their pupils after the lessons. Findings showed that 11 out of the 12 classes mainly used two languages (English and pupils mother tongue) in mathematics classroom discourse. More English was used in teaching mathematics to the good classes than the weak classes in all the three types of primary schools. However, there was no difference in the language use between expert and novice mathematics teachers. While English was the main language of procedural Discourse, the pupils' mother tongue played a major role as the language of conceptual Discourse and regulatory Discourse (for non-math talk). Thus, the pupils' mother tongue was an invaluable language to fall back on for the teaching and learning of mathematics in all the three types of schools.

BM version

Kajian ini cuba menangani isu yang mendesak tentang penggunaan bahasa oleh guru matematik dan murid dalam bilik darjah sekolah rendah di Malaysia di bawah dasar Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris [PPSMI]. Satu perbandingan penggunaan bahasa antara guru matematik pakar dengan novis; serta antara murid kelas yang baik dengan yang lemah daripada tiga jenis sekolah rendah telah dijalankan. Data kualitatif dikumpul termasuk 12 rakaman video pelajaran matematik, dan temu bual mendalam dengan enam orang guru matematik serta 10 orang muridnya selepas pelajaran. Analisis data menunjukkan bahawa 11 daripada 12 kelas tersebut kebanyakannya menggunakan dua bahasa iaitu Bahasa Inggeris dan bahasa ibunda murid dalam wacana kelas matematik. Bahasa Inggeris lebih banyak digunakan dalam pengajaran matematik di dalam kelas yang baik berbanding dengan kelas yang lemah bagi ketiga-tiga jenis sekolah rendah. Tetapi, tiada perbezaan dalam penggunaan bahasa antara guru matematik pakar dengan novis. Bahasa Inggeris merupakan bahasa utama bagi wacana prosedural manakala bahasa ibunda murid memainkan peranan penting dalam wacana konseptual dan wacana regulatori yang berbentuk perbualaan bukan matematik. Maka, bahasa ibunda murid adalah bahasa yang amat berguna apabila menghadapi kesukaran dalam pengajaran dan pembelajaran matematik di ketiga-tiga jenis sekolah rendah.

F. **SUMMARY OF RESEARCH FINDINGS**
Ringkasan dapatan Projek Penyelidikan

5.2 Summary of findings

Findings of this study are summarised as follow:

(a) Language use by teachers and students in mathematics classroom discourse

Analysis of the data showed that eleven out of the twelve classes mainly used two languages (English and the mother tongue of the students) in their mathematics classroom discourse, that is, the Chinese Vernacular School used English and Mandarin, the Tamil Vernacular School used English and Tamil, and the National School used English and Malay. In addition, there was a difference in the language used in mathematics classroom discourse between good and weak classes. In general, for all the three grade levels more English was used in teaching mathematics to the good classes than the weak classes in all the three types of primary schools. However, there was no difference in the language used between expert and novice mathematics teachers. In the mathematics classroom discourse, both expert and novice mathematics teachers used more English in good classes than in weak classes. Thus, the usage of English in a mathematics classroom discourse is determined more by the teachers' confidence in their pupils' level of English language proficiency than their years of teaching experience.

(b) Roles of language in a mathematics classroom discourse

(i) Language use for explaining

Teachers' preference in language used for explaining in mathematics classroom discourse might be influenced by their cultural background such as ethnicity and mother tongue as well as their pupils' level of English language proficiency. Both expert and novice teachers in the Chinese Vernacular School, and the Tamil Vernacular School explained in English for good classes but explained in English and Mandarin, and in English and Tamil for weak classes respectively. But, in the National School the Malay mathematics teacher tended to explain in Malay while the Chinese mathematics teacher tended to explain in English. It seems that teachers whose mother tongue is the same as that of their pupils tended to use the mother tongue more than those who do not share the same cultural background.

(ii) Language use for questioning

Likewise, teachers' preference in language use for asking questions to pupils in mathematics classroom discourse might also be influenced by their cultural background and their pupils' level of English language proficiency. Both expert and novice teachers in the Chinese Vernacular School, and the Tamil Vernacular School questioned in English for good classes but questioned in English followed by Mandarin, and in English followed by Tamil for weak classes respectively. However, pupils in all the three types of schools preferred to use their mother tongue for asking questions to teacher in mathematics classroom discourse except for mathematical terminology.

(iii) Language use for discussing with peers

The pupils from good classes in all the three types of schools might still try to use English to discuss with each other and code-switched with their mother tongue for mathematical terminology. That is, the Chinese Vernacular School used English and code-switched with Mandarin, the Tamil Vernacular School used English and code-switched with Tamil, and the National School used English and code-switched with Malay. But the pupils from weak classes in all the three types of schools would use their mother tongue to discuss with their peers. It appears that most of the pupils were more comfortable to discuss with their peers in their mother tongue, except when using mathematical terminology. Therefore, English remains as a secondary language for the majority of Malaysian primary pupils.

However, there was a difference in the language used for discussing with colleagues among the three types of primary school mathematics teachers. The Chinese Vernacular School mainly used Mandarin but the Tamil Vernacular School tended to use more English. In contrast, in the National School, the language choice seemed to depend on the ethnicity of the speakers. If both speakers are of different ethnicity, then they most likely speak English to each other. In contrast, if both are Malays, then they might speak in English provided both are fluent in English, or else they will usually speak Malay mix with mother tongue.

(c) Mismatch of language used between teachers and students

Analysis of the data highlighted four types of Discourses, namely, regulatory, procedural, conceptual and contextual Discourses. While English was the main language of procedural Discourse, the pupils' mother tongue played a major role as the language of conceptual Discourse as well as for non-math talk in regulatory Discourse. Thus, the pupils' mother tongue was an invaluable language to fall back on for the teaching and learning of mathematics in all the three types of schools.

Talking mathematics in English is indeed an interesting phenomenon in Malaysian schools. The patterns of use are complex because the discourse in the mathematics classroom manifests the interplay of pupils' and teachers' proficiency in English and the language of assessment arising from a language-in-education policy. An equally important societal force comes from the expectations of parents on the use of English for the teaching and learning of mathematics. This aspect has not been discussed in this study.

G. **COMPREHENSIVE TECHNICAL REPORT**

Laporan Teknikal Lengkap

Applicants are required to prepare a comprehensive technical report explaining the project.
(This report must be attached separately)
Sila sediakan laporan teknikal lengkap yang menerangkan keseluruhan projek ini.
[Laporan ini mesti dikepilkan]

List the key words that reflect your research:
Senaraikan kata kunci yang mencerminkan penyelidikan anda:

English	Bahasa Malaysia
Language use	Penggunaan bahasa
Mathematics Classroom discourse	Wacana kelas matematik
Primary school	Sekolah rendah

H. **a) Results/Benefits of this research**
Hasil Penyelidikan

No. *Bil:*	Category/Number: *Kategori/ Bilangan:*	Promised	Achieved
1.	**Research Publications (Specify target journals)** *Penerbitan Penyelidikan (Nyatakan sasaran jurnal)*	3	2 published 4 submitted for review
2.	**Human Capital Development**		
	a. Ph. D Students	**1**	**Final draft**
	b. Masters Students	**1**	**1**
	c. Undergraduates (Final Year Project)		
	d. Research Officers		
	e. Research Assistants	**0**	**3**
	f. Other: Please specify		
3.	**Patents** *Paten*		
4.	**Specific / Potential Applications** *Spesifik/Potensi aplikasin*		
5.	**Networking & Linkages** *Jaringan & Jalinan*		
6.	**Possible External Research Grants to be Acquired** *Jangkaan Geran Penyelidikan Luar Diperoleh*		

- Kindly provide copies/evidence for Category 1 to 6.

b) Equipment used for this research.
Peralatan yang telah digunakan dalam penyelidikan ini.

Items *Perkara*	Approved Equipment	Approved Requested Equipment	Location
Specialized Equipment Peralatan khusus	1. notebook computer 2. Laser printer 3. NVivo 8 software		1. it was lost due to burglary (police report attached) 2 & 3. School of Educational Studies, USM
Facility Kemudahan			
Infrastructure Infrastruktur			

- Please attach appendix if necessary.

I. **BUDGET** / *BAJET*

Perbelanjaan :Expenditure

Project Account No.	: 1001 / PGURU / 811019
Total Approved Budget	: RM 60 000
Total Additional Budget	: RM 0
Grand Total of Approved Budget	: RM 60 000

Yearly Budget Distributed

Year 1	: RM 35000
Year 2	: RM 25000
Year 3	: RM 0

Additional Budget Approved

Year 1	: RM 0
Year 2	: RM 0
Year 3	: RM 0

Total Expenditure	: RM 58849.20
Balance	: RM 1150.80

- **Please attach final account statement from Treasury**

24/4/2010

Signature of Researcher
Tandatangan Penyelidik

Date
Tarikh

Prof. Madya Dr. Lim Chap Sam
Pensyarah
Pusat Pengajian Ilmu Pendidikan
Universiti Sains Malaysia

H.	**COMMENTS OF PTJ'S RESEARCH COMMITTEE** *KOMEN JAWATANKUASA PENYELIDIKAN PERINGKAT PTJ*

General Comments:
Ulasan Umum:

A very productive research with six publication in international journal.

.....

Signature and Stamp of Chairperson of PTJ's Evaluation Committee
Tandatangan dan Cop Pengerusi Jawatankuasa Penilaian PTJ

DR HASHIMAH MOHD YUNUS
COORDINATOR
BASIC EDUCATION RESEARCH UNIT
UNIVERSITI SAINS MALAYSIA
11800 PENANG

Date : 27/4/10
Tarikh :.....

Signature and Stamp of Dean/ Director of PTJ
Tandatangan dan Cop Dekan/ Pengarah PTJ

Date : 24/04/10
Tarikh :.....

Profesor Dr. Abdul Rashid Mohamed
Dekan
Pusat Pengajian Ilmu Pendidikan
Universiti Sains Malaysia

H. Results or Benefits of the research

1. **Research publications:**

a. Published journal article

1 Kor, Liew Kee, Lim, Chap Sam, Chew, Cheng Meng, & Tan, Kok Eng (2009). Pupils' language preferences and its related reasons and problems in learning primary school mathematics. *The Mathematics Educator, 12* (1), pp.15-32.

2 Lim Chap Sam & Nerida Ellerton (2009). Malaysian experiences of teaching mathematics in English: Political dilemma versus reality. In Tzekaki, M., Kaldrimidou, M. & Sakonidis, C. (Eds.). *Proceedings of the 33rd Conference of the International Group for the Psychology of Mathematics Education, Vol. 4,* pp.9-16. Thessaloniki, Greece: PME.

b. Submitted journal articles

3 Lim, Chap Sam & Presmeg, Norma (accepted for minor changes). Teaching Mathematics In Two Languages: A Teaching Dilemma Of Malaysian Chinese Primary Schools. Submitted to *International Journal of Science and Mathematics Education.* (March 2009)

4 Lim, Chap Sam, Kor, Liew Kee, Tan, Kok Eng, & Chew, Cheng Meng (under review). Responding to language policy change: How multilingual primary school teachers and pupils communicate in mathematics classes. Submitted to *Journal for Research in Mathematics Education.* (31 Jan 2010)

5 Tan, Kok Eng, Lim, Chap Sam, Kor, Liew Kee, & Chew, Cheng Meng (accepted for major changes-under revision). Talking mathematics in English. Submitted to *The Asia-Pacific Education Researcher.* (Jan 2010)

6 Chew, Cheng Meng, Lim, Chap Sam, Tan, Kok Eng, & Kor Liew Kee (under review). Primary Pupils' English Language Proficiency and Problems Faced in Learning Mathematics in English. Submitted to the *Journal of Science and Mathematics Education in Southeast Asia* (5 Nov 2009).

2. **Human Capital Development:**

1. Master Student 1: Masitosh bt Ismail (2008). Komunikasi dalam kelas matematik: Satu kajian kes.
2. EdD student 1: Neo Kian Seng (final draft). Functions of code switching in mathematics classroom in primary school.
3. Research assistants: a) Loo Shan Lin ; b) Chia Hui Min and c) Tan Phei Ling

INTERNATIONAL GROUP FOR THE PSYCHOLOGY OF MATHEMATICS EDUCATION

PROCEEDINGS

of the 33rd Conference of the International Group for the Psychology of Mathematics Education

In Search for Theories in Mathematics Education

EDITORS
Marianna Tzekaki
Maria Kaldrimidou
Haralambos Sakonidis

Volume 4

Research Reports [Lei - Rob]

PME 33, Thessaloniki - Greece
July 19-24, 2009

Cite as:
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Website: **http://www.pme33.eu**

The proceedings are also available on CD-ROM

ISSN 0771-100X

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Research Reports

c/o National Institute of Education
Nanyang Technological University
1 Nanyang Walk
Singapore 637616

The Mathematics Educator is an official publication of the Association of Mathematics Educators, Singapore, and has its primary purpose to provide opportunities for disciplined inquiry and discussion into mathematics education. Trends, issues and developments in curriculum and instruction in mathematics education at all levels with the aim of informing mathematics instruction and learning are presented. The research reports may include, for example, experimental, case study, survey, historical or philosophical studies.

Contributions in the form of articles, book reviews, research papers, brief reports, and so on, should be submitted to the Editor, *The Mathematics Educator*. Note, however, the views expressed or implied in this publication, unless otherwise stated, should not be interpreted as those endorsed by the Association. For notes to contributors, please refer to inside back cover.

ISSN 0218-9100 Cover designed by Ms Emily Ng

THE MATHEMATICS EDUCATOR

2009 *Volume 12* *Number 1*

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Gmail by Google

Chapsam LIM <chpsam@gmail.com>

Your Submission IJMA625R2

3 messages

Jacquiline Dy(IJMA) <jacquiline.dy@springer.com> **Mon, Apr 19, 2010 at 1:19 PM**
To: cslim@usm.my, chpsam@gmail.com

Dear Author,

We have received the reports from our advisors on your manuscript, "TEACHING MATHEMATICS IN TWO LANGUAGES: A TEACHING DILEMMA OF MALAYSIAN CHINESE PRIMARY SCHOOLS", submitted to
International Journal of Science and Mathematics Education

Based on the advice received, the Editor has decided that your manuscript can be accepted for publication after you have carried out the corrections as suggested by the reviewer(s).

Attached, please find the reviewer's comments for your perusal. You are kindly requested to also check the website for possible reviewer attachments.

Please submit your revised manuscript online as soon as possible,by using
the Editorial Manager system which can be accessed at:

http://ijma.edmgr.com/

Your username is: chapsam
Your password is: [redacted]

I am looking forward to receiving your revised manuscript
before 21 Jun 2010.

With kind regards,
Springer
The Editorial Office
P.O. Box 990
3300 AZ DORDRECHT
The Netherlands

Comments for the Author:

Reviewer #1: I am convinced with the author(s)'s response to my previous comments

Reviewer #3: Dear author(s),

I have read the manuscript again, as well as the author's response to thr reviewers' comments, and am satisfied that this current version of the submission may be accepted for publication, subject to the following minor points being addressed by the author(s) - that is, I am not recommending another round of reviewing:

p 6 line -2: When "students in Chinese schools (SJKC) consistently achieved better than their counterparts in SK and SJKT schools", explain how the achievement was measured. Is it test scores, and if so, are the tests/exams unified across the school types? Or does this statement come from results of inter-school events? Etc

p 8 line 8: Delete 'each'

New Manuscript uploaded: #10120 publication x

from	**Journal for Research in Mathematics Education** <jrme@nctm.org>
reply-to	Journal for Research in Mathematics Education <jrme@nctm.org>
to	chpsam@gmail.com
date	Sun, Jan 31, 2010 at 2:04 PM
subject	New Manuscript uploaded: #10120
mailed-by	mthed.ed.psu.edu

Dear Chap Sam Lim,

We would like to thank you for your submission to JRME. Your manuscript 'RESPONDING TO LANGUAGE P
TEACHERS AND PUPILS COMMUNICATE IN MATHEMATICS CLASSES' has been assigned number 1012(
We will now begin the process of finding reviewers for your manuscript.
You can continue to log onto the database and check the status of your manuscript,
or you can contact our staff assistant at jrme@nctm.org or (814) 867-2135.
Thank you

M. Kathleen Heid
Editor
Journal for Research in Mathematics Education

Reply Forward

p 17 line 12: Replace 'recorded' with 'record'

p 30 line 6: Replace 'translation' with 'translations'

p 30 line 13: Replace 'good class pupils' with 'pupils from the good class'

Lastly, I suspect that the educational phenomenon that has been investigated in the study reported here might have changed in 2009 (but I may well be wrong here!). The author(s) may want to acknowledge this policy development at the end of this article.

All the very best!
Reviewer #3

Chapsam LIM <chpsam@gmail.com> **Mon, Apr 19, 2010 at 2:07 PM**
To: "Jacquiline Dy(IJMA)" <jacquiline.dy@springer.com>
Cc: Norma Presmeg <npresmeg@ilstu.edu>, Norma Presmeg <npresmeg@msn.com>

Dear Jacquiline

Thanks for the email and good news. I will proceed to make the correction and send you soonest possible.

take care

chapsam

[Quoted text hidden]

Dy, Jacquiline <Jacquiline.Dy@springer.com> **Tue, Apr 20, 2010 at 12:07 AM**
To: Chapsam LIM <chpsam@gmail.com>

Dear Dr. Lim,

Thank you for your email.

We will be looking forward to receiving your revised manuscript.

Should you have any questions or concern, kindly contact me.

Kind regards,
Jacqui

Ms. Jacquiline Dy
Springer
JEO Assistant
---
fax +63 2 3250601
jacquiline.dy@springer.com
http://www.springer.com

From: Chapsam LIM [mailto:chpsam@gmail.com]
Sent: Mon 4/19/2010 2:07 PM
To: Dy, Jacquiline
Cc: Norma Presmeg; Norma Presmeg
Subject: Re: Your Submission IJMA625R2

FW: The Asia-Pacific Education Researcher

Tan Kok Eng

Sent: Sunday, April 11, 2010 9:12 AM
To: Lim Chap Sam; Dr Kor Liew Kee [korlk564@kedah.uitm.edu.my]; Chew Cheng Meng
Importance: High
Attachments: TAPER 09-L12 comments.doc (179 KB)

Dear All,
The review outcome just came. I am going ahead with the next stage. Any contribution from anyone of you to address specific issues highlighted by the reviewer is most welcome. Wish me luck!
KE

From: Allan Benedict I. Bernardo [allan.bernardo@dlsu.edu.ph]
Sent: Friday, April 09, 2010 7:14 PM
To: Tan Kok Eng
Cc: taper.files@yahoo.com
Subject: The Asia-Pacific Education Researcher

Dear Dr. Tan:

I am pleased to transmit to you the comments from the reviewer of your manuscript entitled, "Talking Mathematics in English" (MS#09-L12). The reviewer's comments are attached to this document, and you will note that the reviewer has found good qualities in your paper, but also notes many areas were the paper can be improved. Please also see the comments made on the attached manuscript.

Considering these concerns, I cannot accept your manuscript for publication. However, I strongly encourage you to revise you manuscript to address the comments of the reviewer.

If you decide to revise the manuscript, please notify me by email as soon as possible. Please email me your revised manuscript not later than 90 days after receipt of this review (i.e., by July 10, 2010). Please also include a cover letter explaining the revisions you undertook to address the various points raised by your reviewer. I will decide whether to send back your revised manuscript to the original reviewer, or whether an editorial decision can be made at that point.

If you decide not to revise the manuscript, please also notify me as soon as possible.

Thank you for considering *The Asia-Pacific Education Researcher* as a venue for your research outputs.

Best regards,

Allan B. I. Bernardo
Editor

***The Asia-Pacific Education Researcher* is indexed and abstracted in the Social Sciences Citation Index, Social Scisearch, and Journal Citation Reports/Social Scienced Edition. *The Asia-Pacific Education Researcher* is listed in Thomson ISI and SCOPUS.**

Comments of Reviewer A

The paper discusses a very interesting context that is relevant to a whole lot of countries in the rejoin that uses English to teach mathematics and science. It describes the situation in Malaysia well. The methodology is well described and analyss well presented in general.

There are many places I have noted on the document itself that might assist the author to provide more information and support to the statements made to make it read more like an academic paper. In particular

this refers to the first section of the paper.

Many of the changes I have suggested are minor to warrant a resubmission. However, I have one problem with the paper as it related to the theory used and the type of data analysed.

The paper is located within the sociocultural perspective of Vygotsky. It also used the big D and little d concepts of discourse. However, the analysis conducted is merely counting the number of utterances in either English or native language and the type of statements made. I am not convinced that the data collected does really illustrate the relevance of the theoretical models used. It is not that I don't think the theoretical model is useful – but rather that the analysis does not illustrate it. There are many other approaches that one could have used in discussing the student – bilingual education, code switching etc. it is a challenge to the author(s) to try to demonstrate the relationship between the data and the theory in a stronger way.

FW: Submission of article for publication in the Journal of Science and Mathematics Education in Southeast Asia

Chew Cheng Meng

Sent: Wednesday, April 21, 2010 8:16 PM

To: Lim Chap Sam

From: UiHock_Cheah [uhcheah@recsam.edu.my]
Sent: Thursday, November 05, 2009 4:08 PM
To: Chew Cheng Meng
Subject: RE: Submission of article for publication in the Journal of Science and Mathematics Education in Southeast Asia

Thanks Chew for the manuscript. I had quickly run through the paper and found that there are some data recorded in bahasa Malaysia or Chinese. It would be good to translate them so that the reviewers can understand what it says.

I will send to the reviewers after CoSMEd.

Thanks again.

Best regards,
Ui Hock

Cheah Ui Hock (Ph.D.)
Head of Division (Research and Development),
SEAMEO RECSAM,
11700 Gelugor,
Penang, Malaysia

Tel: (+60 4) 6522700 ext 760
DL: (+60 4 6522760
Fax: (+60 4) 6522737
Email: uhcheah@recsam.edu.my
Website: www. recsam.edu.my

From: Chew Cheng Meng [mailto:cmchew@usm.my]
Sent: Thursday, November 05, 2009 1:50 PM
To: director@recsam.edu.my
Cc: ,; Lim Chap Sam; Tan Kok Eng; ,
Subject: Submission of article for publication in the Journal of Science and Mathematics Education in Southeast Asia

Dear Director of SEAMEO RECSAM,
Please find attached a copy of the article for publication in the Journal of Science and Mathematics Education in Southeast Asia.
Thank you very much.

Dr.Chew Cheng Meng
Pusat Pengajian Ilmu Pendidikan

KOMUNIKASI DALAM KELAS MATEMATIK: SATU KAJIAN KES

Oleh

MASITOH BINTI ISMAIL
(S-PM0094/05)

Laporan Projek Penyelidikan sebagai syarat separa untuk keperluan Ijazah Sarjana Pendidikan

Pusat Pengajian Ilmu Pendidikan
Universiti Sains Malaysia

MEI 2008

BORANG KG 1-3

UNIVERSITI SAINS MALAYSIA

KENYATAAN GAJI KAKITANGAN PROJEK SAMBILAN
(HENDAKLAH DIISI DALAM *5 SALINAN* DAN KEMBALIKAN KE PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN, BANGUNAN CANSELORI, ARAS 6)

Bil: 613 - 2008 - Tarikh: 11 MAC 2008

Kepada : **BENDAHARI**

Perlantikan Baru/Perubahan Semasa Berkhidmat/Perletakan Jawatan bagi Kakitangan-Kakitangan Projek Sambilan Untuk Jangkamasa **Maksimum 3 bulan sahaja**. ***Borang ini hanya untuk calon warganegara Malaysia sahaja.***

1. Nama: LOO SHAN LIN (HURUF BESAR) Jantina:L/P:- Perempuan
2. Jawatan: PEMBANTU PELAJAR" *No.Matrik Pelajar: 84092
3. Alamat Tetap: 252, Jalan Seroja, Taman seroja, 09000 Kulim, Kedah Darul Aman No. Tel/H/p: 017-4890040
4. Tarikh Lahir: 25-01-1985 No.K/P (Baru): 850125-07-5008
5. Jangkamasa Perlantikan: 15 MAC 2008 Hingga: 14 JUN 2008
6. Pusat Pengajian Ketua Projek: Ilmu Pendidikan Keputusan Peperiksaan: 8pm *(Lampirkan 1 salinan sijil)*
7. (a) Jika Siswazah Lanjutan nyatakan taraf di Institut Pengajian Siswazah: *Penuhmasa/Sambilan*
   (b) Jika pelajar Penuhmasa, adakah itu merupakan projek tahun akhir: ~~*YA*~~*/TIDAK*
8. (a) Tajuk Projek: Communication and Language used in Mathematics Classroom Discourse
   (b) Ketua Projek: Prof Madya DR LIM CHAP SAM
   (c) Sumber Pembiayaan Projek: ~~*USM JANGKA PENDEK / FUNDAMENTAL (FRGS)*~~/ RU *FUNDAMENTAL* ~~*(TOP DOWN) / IRPA KATEGORI EA/PR/SR / GERAN LUAR*~~
   (d) No. Akaun Projek: 1001 / PGURU / 811019
9. Gaji Harian: RM 25/= + (Imbuhan Tetap Khidmat Awam) = RM —
   Gaji Bulan : RM — + (Imbuhan Tetap Khidmat Awam) = RM —
   + (Bantuan Sara Hidup) = RM —
10. No. Akaun Bank (BCB/Muamalat) Kakitangan Projek: 0709-007125-52-8
11. Kadar Persaraan/KWSP 11% : 12% No. KWSP: — *(Sila Lihat Nota**)*
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UNIVERSITI SAINS MALAYSIA

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(HENDAKLAH DIISI DALAM *5 SALINAN* DAN KEMBALIKAN KE PEJABAT PENGURUSAN & KREATIVITI PENYELIDIKAN, BANGUNAN CANSELORI, ARAS 6)

Bil: 155 - 2008 Tarikh: _____

15 MAY 2008
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3. Alamat Tetap: POS 1, BATU 2, JALAN BAKRI, 84000 MUAR, JOHOR.
4. Tarikh Lahir: 9 - 6 - 1985 No.K/P (Baru): 850609-01-6098
5. Jangkamasa Perlantikan: 1 MEI 2008 Hingga: 31 JULAI 2008
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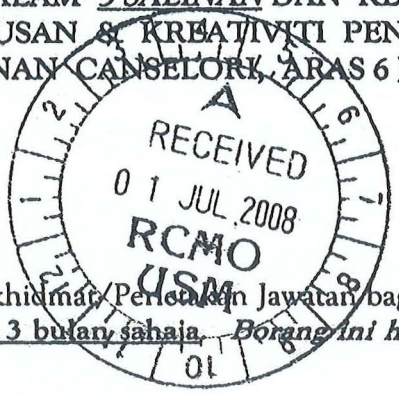

Bil: 710 - 2008 (2)

Tarikh: _____

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3. Alamat Tetap: 790-F, MK 13, LORONG SUNGAI DUA 11700 PENANG No. Tel/H/p: 016-4848102
4. Tarikh Lahir: 05 JANUARY 1985 No.K/P (Baru): 850105075262
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Nama Projek: Communication and Language used in mathematics classroom discourse

Ketua Projek: Prof Madya Dr Lim Chap Sam

Pusat Pengajian Ilmu Pendidikan

No. Akaun: 1001/PGURU/811019

Tanggungan Perbelanjaan Jan hingga April 2010 (dalam tanggungan)

Tarikh	Vot	Perbelanjaan	Jumlah (RM)	Catatan
29/1/10	2700	Hard disk dan CD drive	888.00	Dalam proses di bendahari
19/3/10	2900	Hotel Regent Gunung Jerai	4,940.00	Dalam tanggungan
	21000	Tuntutan perjalanan oleh Chew Cheng Meng	180.00	Bengkel penulisan laporan teknikal di Gunung Jerai. (19-21 Mac 2010)
	21000	Tuntutan perjalanan oleh Lim Chap Sam	152.70 (DAPAT)	
	2900	Imbuhan makan tengahari utk penyelidik	65.30 (DAPAT)	
19/4/10	2900	Imbuhan makan tengahari utk penyelidik	75.60	Dalam tanggungan
19/4/10		Pembelian IC recorder	599.00	Dalam tanggungan
21/4/10		Percetakan laporan	2800.00	Dalam tanggungan
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		Jumlah besar tanggungan:	**16, 251.60**	
Baki peruntukan projek: 17402.40 – 16251.60 =			**1150.80**	

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111	PGURU	811019		18,000.00	1,284.75	16,715.25	0.00	0.00	0.00	16,715.25
221	PGURU	811019		18,400.00	15,828.43	2,571.57	0.00	0.00	0.00	2,571.57
223	PGURU	811019		150.00	0.00	150.00	0.00	0.00	0.00	150.00
227	PGURU	811019		1,750.00	1,752.23	-2.23	0.00	0.00	0.00	-2.23
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229	PGURU	811019		11,600.00	13,587.19	-1,987.19	0.00	0.00	0.00	-1,987.19
335	PGURU	811019		9,100.00	10,125.00	-1,025.00	0.00	0.00	0.00	-1,025.00
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220	PERKHIDMATAN DAN BEKALAI	32,900.00	31,187.85	1,712.15	0.00	0.00	0.00	1,712.15
330	ASET	9,100.00	10,125.00	-1,025.00	0.00	0.00	0.00	-1,025.00
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PLANNING AND FINANCIAL SERVICES DIVISION

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Kepada:

Profesor Madya Lim Chap Sam
Pensyarah
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Universiti Sains Malaysia

No. Rujukan : USM.17/SBP(o)/H/JKH
(Kes 23/2009)

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22 Rabiulawwal 1431H

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2. Untuk makluman puan, pihak insuran telah membayar pampasan sebanyak RM5,000.00 sebagai bayaran gantirugi terhadap kehilangan alatan ini.

3. Dengan ini, saya mewakili Jawatankuasa Kehilangan dan Hapuskira ingin memaklumkan bahawa kes ini telah ditutup dan dianggap selesai.

Sekian, terima kasih.

"BERKHIDMAT UNTUK NEGARA"

`Memastikan Kelestarian Hari Esok'

(NURUL HAYATI AZME)
Penolong Bendahari
Selaku Setiausaha Jawatankuasa Kehilangan dan Hapuskira

s.k. Timbalan Naib Canselor
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Selaku Pengerusi Jawatankuasa Kehilangan dan Hapuskira

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NO.KP. 541028075381
(Alamat) : **23 LORONG MAHSURI 7, BAYAN BARU 11950**
BAYAN LEPAS PULAU PINANG

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POLIS DIRAJA MALAYSIA

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BALAI DAN NO. REPOT :**BAYAN LEPAS RPT. NO.8782/2009.**
KESALAHAN : **SEK.457 KK**

Dengan hormat,merujuk kepada lapuran Polis No **8782/2009** yang dibuat
oleh *tuan / puan **02/11/2009** (tarikh) di Balai Polis pada
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Technical report for RU project: 1001/PGURU/811019

Communication and Language Use in Primary Mathematics Classroom Discourse

LIM Chap Sam

CHEW Cheng Meng

KOR Liew Kee

TAN Kok Eng

School of Educational Studies

Universiti Sains Malaysia

2010

TABLE OF CONTENTS

ACKNOWLEDGEMENTS

This monograph is made possible by the generosity and kind cooperation of many people, particularly the teachers and pupils of the participating schools. Due to confidentiality requirement, we cannot name them personally. We also would not forget the kind cooperation of the school administrators for allowing us to observe and interview the teachers and pupils in their schools. We would like to express our highest appreciation to these teachers and pupils for giving us their time and thought. We also hope these teachers and pupils have gained much meaningful experiences from this endeavor.

Most of all, we wish to express our gratitude to the Universiti Sains Malaysia for providing a Research Grant that funded this study; and to the Dean of the School of Educational Studies, USM, Professor Dr Abdul Rashid Mohammed for his encouragement and continuous support.

Chapter One

INTRODUCTION

1.1 Introduction

Many believe that mathematics knowledge and skills are more likely taught and learnt formally in school, in interactions involving verbal communication between teachers and students. As the National Council of Teachers of Mathematics [NCTM] (2000) has put it, "communication is an essential part of mathematics and mathematics education. It is a way of sharing ideas and clarifying understanding. Through communication, ideas become objects of reflection, refinement, discussion, and amendment." (p. 60). For communication to take place, language plays a central role. However, the teaching and learning of mathematics in the classroom, mediated by language, becomes complex especially in bilingual or multilingual contexts.

The present research addressed the urgent need to explore the kind of language(s) used by mathematics teachers and students in the Malaysian primary classroom. In this report, a comparison of language use by mathematics teachers and students from 12 Malaysian primary school mathematics classrooms was done. This included the examination of the similarities and differences in language use by expert and novice teachers in the three major types of primary schools in the country. Important pedagogical and policy implications for the teaching and learning of mathematics will be drawn from the major findings of the study.

1.2 Background of the study

Medium of Instruction (MOI)

The language of instruction for mathematics has been debated in a number of multilingual contexts. There is concern that the choice of a particular language as the MOI may privilege some learners while disadvantaging others. The argument is straightforward. One cannot teach mathematics without considering the vehicle of transmitting this knowledge. Mathematical concepts are not delivered with symbols alone but communicated through the use of language to explore, explain, reason and argue to achieve understanding. Additionally, from a sociocultural perspective, choice of language is linked to issues of identity and power. The English Language seems to be embroiled in the MOI tussle due to its historical roots in many educational systems in the world and the perceived value associated with the use of this international language.

Indeed the choice of English over the students' mother tongue as a medium of instruction is an issue in Hong Kong. Poon (2004) has described the medium of instruction as "the most thorny and tricky issue in Hong Kong education" (p.55). As English is regarded as a language of power and prestige, "Over 90% of secondary schools opted for English as the medium of instruction (EMI). The remaining schools chose Chinese as the medium of instruction (CMI). Thus most students had to switch from Chinese to English as the MOI when they started their secondary schooling, irrespective of whether their proficiency in English was adequate or not" (Yip & Tsang, 2007, p.394). According to Poon (2004) the actual practice is the use of a mixed code of English and Chinese, rather than English only. Additionally, Yip and Tsang's (2007) review of some local studies revealed that many EMI students' learning was affected

by the use of English. Not only that, "there was no evidence that these students developed adequate English proficiency through immersion in English" (p.394). However in their own longitudinal study following a group of students from 100 schools from secondary one for three years, Yip and Tsang (2007) reported that EMI students had higher self-concepts in Chinese, English and Mathematics, but a lower self-concept in science when compared with CMI students.

In the United States, research is ongoing to address problems faced by learners with low proficiency in English and bilingual Latinos in learning mathematics. Moschkovich (2002), for example, has proposed three perspectives to describe mathematics learning and its relation to language among language-minority Latino students. The first perspective emphasizes the acquisition of vocabulary; the second perspective emphasizes word meanings while the third situated-sociocultural perspective explains discourse, register, bilingualism and code switching in the mathematics classroom. This last perspective, underpinned by Gee's (1996) concept of Discourses, was taken up by Setati (2005) in her theorizing of bilingualism in the mathematics classroom in South Africa.

Studies connecting the teaching and learning of mathematics and language are varied, employing different perspectives and methodological approaches. The next section will look at how a language-in-education policy affecting science and mathematics teachers and learners in Malaysia.

PPSMI: The case of Malaysia

PPSMI is the Malay abbreviation for *Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris*, which stands for the Teaching and Learning of Science and Mathematics in English. PPSMI is another language-in-education policy in Malaysia which came into effect in 2003. English was systematically phased in to replace the Malay language as the medium of instruction for Science and Mathematics in school. This significant curricular innovation involved the development of new teaching materials together with supporting materials for teachers and the retraining of teachers for their task.

Since the implementation of the PPSMI policy, a number of studies have been carried out to explore the readiness and perceptions of teachers and students concerned. For example, Lim and Wun (2003) surveyed the readiness of 124 primary and secondary mathematics teachers for the language switch one year after the policy was implemented. These respondents were selected randomly from three northern states in Peninsular Malaysia. The findings showed that 38 per cent of the teachers rated their oral English language proficiency as "fluent" and 35 per cent rated their written English as "good." Seven per cent considered themselves "poor" in writing and speaking. In contrast, 80 per cent rated themselves as "fluent" in speaking and "good" in writing in the Malay language.

Two years after the policy was implemented, Lim and Chee (2005) repeated the survey with 125 secondary school mathematics teachers attending a workshop on PPSMI. A similar trend was observed. While 83 per cent of the teachers were comfortable in using the Malay language, less than 25 percent of them rated themselves as "good" in oral and writing skills in English. At the other extreme, nearly a tenth of them could not speak or write well in English. Additionally, senior teachers aged 40 years and above were more proficient in English than their more junior counterparts. The most significant finding was that only a mere 16 per cent of these teachers conducted their mathematics lessons entirely in English. For various reasons the rest resorted to using their mother tongue.

In a similar study involving 575 secondary teachers under the PPSMI programme sampled purposively from six different zones in East and Peninsular Malaysia, Hamidah et al. (2005) reported that 43 per cent of the respondents disagreed with the statement that they possessed

the spoken ability to teach science and mathematics in English. Nevertheless, 81 per cent of the respondents indicated that they were confident to teach the two subjects in English after the programme was implemented and 75 per cent agreed that they had the ability to explain science and mathematics concepts in English. Tan (2006) repeated the same study with 83 SK and 112 SJKC mathematics teachers randomly selected from 24 schools in the state of Penang. Her findings reconfirmed that most mathematics teachers were more confident and proficient in their mother tongue than in English. More than 90 per cent of the SK teachers reported they were fluent in the Malay language compared with 35 per cent in English. Similarly, the same proportion of the SJKC teachers was fluent in Mandarin compared with only 20 per cent in English. While 80 per cent of both the SK and SJKC teachers expressed readiness to teach science and mathematics in English, only 50 percent of the SK teachers and 38 percent of the SJKC teachers favoured teaching mathematics in English and would do so even without the 5 per cent teaching incentive payment.

After five years of PPSMI implementation, Lim, Saleh and Tang (2007) surveyed the perspectives of 20 primary school administrators, 443 mathematics and science teachers, and 787 primary Year 5 pupils from 20 schools in three northern states of Peninsular Malaysia. Two survey questionnaires were used: one for the mathematics teachers and the other for the pupils. The teacher questionnaire consisted of four sections, namely, the background of respondents, teachers' self-assessed reports of their language proficiency, issues and problem faced, and teachers' perceptions regarding the teaching of mathematics and science in English. Teachers' perceptions were measured on a five-point Likert scale, ranging from "strongly disagree" to "strongly agree." A major shocking finding was that only 11% of the mathematics teachers explained mathematical concepts entirely in English. The implication is that an overwhelming majority of nearly 90 per cent of these teachers were not teaching mathematics fully in English. They resorted to using the pupils' mother tongue (either Malay or Mandarin) in their instructions. This phenomenon occurred more often among the SJKC than the SK teachers as well as more often in rural schools than urban schools. When linked to the teachers' self-rated language proficiency in the three languages it was not surprising to find that almost one-fifth of the teachers rated themselves as "poor" in spoken and written English. Conversely, the majority of the teachers were much more confident in Mandarin or the Malay language than in English in both speaking and writing. It was highly probable that the teachers' lack of proficiency in English greatly lowered their confidence and use of English in the mathematics classroom.

The review of the above studies, especially Malaysian studies on PPSMI, has released a host of questions regarding the actual patterns of language use in the teaching and learning of mathematics in the local context. If English is not favoured or used as the language of instruction, which language or languages are used then in the classroom? Would there be a substantial amount of code-switching and translation? What role does English actually play in the classroom? These questions require a more qualitative approach as compared to the quantitative approach adopted by the studies reviewed. For this purpose the present study was undertaken to explore language use in an actual Malaysian mathematics classroom context.

1.3 Purpose of the study

The broad aim of the study was to investigate the patterns of language use in the basically bilingual primary school mathematics classroom in order to understand the kind of language use and its functions in mathematics classroom discourse.

1.4 Research questions

Specifically, this study addressed the following research questions:

1. Which language is used by teachers and students in a mathematics classroom discourse?
    a. Are there any differences in language use between expert and novice mathematics teachers?
    b. Are there differences in language use by mathematics teachers and students between different types of primary schools?
2. What are the roles of language in mathematical communication?
3. Is there any mismatch of language use between teachers and students?

1.5 Significance of the study

This study was significant in the following ways:

1. Exploring qualitatively mathematics classroom discourse in the Malaysian context contributes towards theorizing on bilingualism and mathematics education.
2. Making a comparison of language use between expert and novice teachers in the different types of primary schools may help to produce a theoretical language model that explains the roles of language in enhancing mathematical communication in the local context.
3. Practicing mathematics teachers who participate in this research and engage in conversations with researchers are actually reflecting on their own practice, thus contributing to their professionalism.
4. These teacher participants hopefully would move on to carrying out small studies in their everyday practice to further improve the process of teaching and learning mathematics in the formal school context.

Chapter Two

LITERATURE REVIEW

2.1 Introduction

This chapter discusses and reviews literature related to language and mathematics learning in three areas: (a) the effect of language of instruction and mathematics learning; (2) learning mathematics in second language; (3) factors affecting the language use in mathematics instruction. The chapter concludes with a proposed conceptual framework for the study.

2.2 The effect of language of instruction on mathematics learning

According to Tucker (1999), the language use in school is very different from the language use at home. He observed that individuals most easily develop cognitive skills and master content material that is taught in a familiar language. He pointed out as well that children learn a second language in different ways depending upon their culture, their peer group, and their individual personality. A close-up glimpse of the context of mathematics instruction shows that language and mathematics have never ceases to prompt researchers (Alder, 1998, 2001; Setati, 1998; Setati & Alder, 2001; Moschkovich, 2002, 2005) to study intently how bilingual or multilingual teachers and students communicate mathematical ideas during mathematics lessons.

The issue of whether mathematics is language-free is also debatable. Gerber (2004) notes that mathematics learning is supposed to be independent of the proficiency in the language of instruction because of the symbolism in mathematics, there are researchers who disagree with this supposition. For example, Lemke (1990, p. 159) states that "... mathematics itself, that is the use of mathematical expressions, is part of language, not something different from or alternative to language." In addition, Barton and Neville-Barton (2003) stress that, "Mathematics is not 'language-free' and the particular vocabulary, syntax and discourse it presents challenges EAP learners *[students attending an English for Academic Purposes course] especially, to develop their literacy in this discipline*" (p. 159). They further argue that, "There is a complex interaction between language features, context features, mathematical knowledge and use of symbols" (p. 27). In fact, the influence of language in learning mathematics among students goes beyond that of the language of instruction (Gerber, 2004).

On matter concerning mathematical communication, Thurston (1995) emphasizes that effective communication of mathematical ideas is the key to achieve the necessary in-depth mathematical understanding or basic mental infrastructure as he calls it, and language forms an integral part of this mathematical communication. This fact is supported by McLean (2000) who points out that many of the learning problems of students originate from an inadequate knowledge of the basic vocabulary. Bohlmann (2001) in supporting Thurston's and McLean's views argues further that language is the medium by which teachers introduce and convey mathematical concepts and procedures, and it is also through language that texts are read and problems are solved. Furthermore, the double task of mastering mathematics content and language poses challenges to second language learners as they have to acquire two conceptually difficult and different skills (Bohlmann, 2001; Rollnick, 2001).

In terms of the languages used in the learning of a technical domain such as mathematics, Mestre (1998) identifies four types of language proficiency that can play a role in mathematical problem solving, namely: (1) proficiency with language in general, (2) proficiency in the technical language of the domain, (3) proficiency with the syntax and usage of the language in the domain, and (4) proficiency with the symbolic language of the domain. While Barton and Neville-Barton (2003) classify written mathematics into five different forms (general English text, mathematical technical text, symbols, diagrams, and graphs), Dale and Cuevas (1987) categorize the mathematics register in a particular language such as English into six types of vocabularies: (1) technical vocabulary (e.g., quadrilateral, algorithm, factorial); (2) everyday vocabulary that takes on different meanings (e.g., rational, range, product, integrate); (3) complex phrases combining more than one concept (e.g., least common multiple); (4) several words signaling the same mathematical concept (e.g., add, sum, and, increase, plus); (5) general English vocabulary; and (6) symbols which can be both conventional and free, depending on context (e.g., +, =, p, x, y).

In addressing students' difficulties in switching between different mathematical languages, Lemke (1990) found that many students experienced difficulty in translating between mathematical symbols, mathematical English sentences, and ordinary English. Many studies also reported that there is a widespread inability of university engineering students to translate relationships expressed in colloquial language into corresponding mathematical expressions, and vice versa (Clement, Lochhead & Monk, 1981; Kaput & Clement, 1979; Rosnick, 1981; Rosnick & Clement, 1980).

2.3 Learning mathematics in second language

There are many types of languages associated with mathematics learning and these languages interact with each other in a complex manner (Gerber, 2004). For example, Barton and Neville-Barton's (2003) study showed that proficiency in mathematical English is a more important factor than proficiency in general English in the learning of university mathematics. In their study of 83 volunteer first year students, they found that because of a lack of understanding of mathematical text, students (mainly Asian) who have English as an additional language (EAL students), were at a 10 percent disadvantage in comparison with English first language students. Further, they found that second language students preferred mathematical symbols to texts, diagrams or graphs to express themselves, especially in the case of text questions although written mathematics can take the form of text, symbols, diagrams or graphs.

Moreover, in a quantitative study of first year calculus university students, Gerber, Engelbrecht, Harding and Rogan's (2005) investigated the differences in performance of Afrikaans first language students who attended Afrikaans lectures and Afrikaans first language students who attended English lectures. According to Gerber et al., Afrikaans is a language of Dutch origin, spoken mostly by white Afrikaners and the Cape Coloured communities. Specifically, Gerber et al. compared the performance of all students who received first language lectures with that of all students who attended second language lectures, and the performance of all non-Afrikaans first language students (mainly African) attending English second language lectures with that of all the Afrikaans first language students attending English lectures that is, comparing the performance of two groups of second language learners. The study found that there was a statistically significant difference in the performance of the Afrikaans students attending Afrikaans lectures and the Afrikaans

students attending English lectures with the former outperforming the latter. However, there was no significant difference between the adjusted means of the entire group of first language learners and the entire group of second language learners. There was also no significant difference between the performances of the two groups of second language learners based on the adjusted means.

In multiracial and multilingual Malaysian society there has been much debate on the language of instruction (using pupils' mother tongue or English which is their second language) for mathematics and science in mainstream education. Research on the significance of implementation of teaching science and mathematics in English has nonetheless brought informative insights to the policy makers. In the secondary schools setting, Lim and Chee (2005) surveyed 125 secondary school mathematics teachers attending a workshop on teaching science and mathematics in English (PPSMI) found that a mere 16 percent of these teachers reported that they conducted their mathematics lessons entirely in English while the rest indicated that they used their mother tongue in teaching mathematics in the classroom. In another study, Hamidah and her colleagues (2005) surveyed 575 secondary school teachers under the PPSMI programme by using a four-point Likert scale questionnaire. Their findings showed that even though 75 percent of the teachers agreed that they had the ability to explain science and mathematics concepts in English, only 57 percent of them agreed that they had the spoken ability to teach science and mathematics in English.

In the primary school setting, Tan (2006) surveyed 83 national school (SK) and 112 Chinese national type school (SJKC) mathematics teachers randomly selected from 24 primary schools in the state of Penang. She found that more than 90 percent of the SK mathematics teachers reported that they were fluent in the Malay language compared with 35 percent in English. Likewise, the same proportion of the SJKC mathematics teachers was fluent in Mandarin compared with only 20 percent in English. In 2007, Lim, Fatimah and Tang studied on 443 primary mathematics and science teachers and 787 primary Year 5 pupils from 20 schools in three northern states of Peninsular Malaysia found that only 11 percent of the mathematics teachers expressed that they explained mathematical concepts entirely in English. Further, 51 percent of the mathematics teachers reported that they used other languages such as Mandarin, Malay or dialects in more than half of the mathematics teaching time. This scenario happened more often among the SJKC mathematics teachers than the SK mathematics teachers as well as more often in rural primary schools than urban primary schools. The overall report shows that there were very few mathematics teachers who were able to use English entirely in teaching mathematics in the classroom.

On the pupils' views, Lim, Fatimah and Tang (2007) found that 74 percent of national schools pupils preferred to learn mathematics and science in English while only 43 percent of the pupils from the Chinese vernacular schools agreed. The pupils from the Chinese schools were also found to be more confident and positive toward learning mathematics and science in Mandarin. Nevertheless, all pupils agreed that the use of English could bring them brighter future.

2.4 Factors affecting the language used in mathematics instruction

The issues of whether there is a preferred language of instruction among the bilingual/multilingual speakers and what are the reasons associated with this choice of language exist and received attentions from many researchers. According to Moschkovich (2007), bilingual learners use many resources to communicate mathematically, for example,

gestures, objects, everyday experiences, their first language, code switching, and mathematical representations. Gerber, Engelbrecht, Harding and Rogan (2005) added that besides student's home language, the linguistic skills of the teacher, the effectiveness of communication between the teacher and student as well as between the student and written text influence the language preference in learning mathematics.

In accordance with Moschkovich (2005), "bilingualism is an individual, social, cultural, historical and political phenomenon" (p.122). In a study that examined the mathematics discourse of the secondary school students in multilingual classrooms, she pointed out that bilingual students' choice of language in mathematics classrooms is specific and situated. She noted the relationship between students' choice of language is dependent on the purpose, the place, the topic, the participant and the social relations among them. These include situation relating to whom the student is addressing (bilingual or monolingual), private or public setting, what mathematical topics are been discussed (algebra, geometry, etc.) and whether it involves oral or written mode, and what social roles participants play (is the speaker addressing a teacher, peers, elders, or children). She added that students' experiences with mathematics instruction can also influence their choice of language used. For example, if students have not been exposed to a particular mathematics topic taught in their first language, then it is reasonable for them to talk about that topic in their second language.

The political role of language in relation to language practices is equally important and has drawn the attention of several researchers (Gee, 1996, Setati, 1998, Zentella, 1997). Of late, Setati's (2005) work on the mathematics teachers teaching in multilingual classrooms in South Africa has shown that political role, pedagogy and cognitive facet are aspects that one will consider when making decisions regarding which language to use, how to use it, and for what purpose. She claimed that language is a political tool which is exhibited when "a teacher enacts multiple identities in and through language in different social situations" (p.451).

Although the preference for a language used is not analogous to code-switching, it shares some similarities in the reasons why it is favoured. For instance, considering Baker's (1993, cited in Setati, 2002, p.14) perceived eight reasons on why code-switching was used, two of the given reasons "for ease and efficiency of expression" and "to express group identity and status or to be accepted by a group" were likely reasons directed to an individual's choice of language. Adding to the above reasons, Merritt, Cleghorn, Abagi and Bunyi's (1992) ethnographic observation of three Kenya primary schools revealed that there were four basic determinants of teachers' language choice and code-switching: (1) official school policy, (2) cognitive concerns, (3) classroom management concerns, and (4) values and attitudes about the appropriate use of multilingualism in society at large.

2.5 Theoretical framework

Review of literatures shows that there are two major theoretical perspectives that evaluate language practices. The psycholinguistic examines language use in experimental settings and opines language is cognitively based while the sociolinguistic examines language use in a natural setting and views language acquisition as cognitive, cultural, social, and situated.

Regardless of language use in experimental or natural settings, there are different viewpoints concerning the use of language as a tool of communication. Sierphinska (1998) proposed three broad epistemological approaches to explain the issue of language and communication in the mathematics classroom. They are the (1) constructivist approach; (2) socio-historical

approach; and (3) interactionist approach. In the constructive approach, the communication pattern in teaching mathematics is centred on "students talking, teacher listening" (p.36). The socio-historical approach insist on students should follow their teacher's lead and maintains that language is primarily a tool of communication that makes possible the passing down of cultural knowledge, values and practices from one generation to the next. The interactionist however, views language as a social practice—a discourse, a language-in-action for accomplishing cognitive, social, and other ends. In the interactionist approach, mathematics teaching and learning is viewed as a discourse in action and Mathematics itself is a language.

In this study, we adopted the socio-historical approach of Vygotsky as our theoretical framework. Vygotsky (1978) contended that language is not only a tool of communication but a tool for reflection and thinking. The transmission cultural knowledge, values and practices from teacher to students is made possible through the use of language. Hence, competency in the language of communication and thought becomes a prerequisite for effective engagement in the teaching and learning process. The Vygotskian approach is located within a social context. This social context starts from the mathematics classroom which is embedded within the school institution and moves beyond the school to progressively larger contexts.

In addition, we espoused Gee's (1996) definition of Discourses as "ways of being in the world, or forms of life which integrate words, acts, beliefs, attitudes, social identities, as well as gestures, glances, body positions and clothes" (p. 127). The upper case D Discourse deals with mathematics teachers' ways or everyday practices in the classroom. A breakdown of Discourse in mathematics instruction produces additional elements for exploration. From a situated socio-cultural perspective, we embraced Moschkovich's (2002) view that communication in a mathematics classroom is participation in mathematical Discourse practices. We subsequently adopted Setati's (2005) mathematical Discourses and nonmathematical Discourses. Mathematical Discourses has two distinct entities: procedural and conceptual. The procedural Discourse is about doing mathematics as following some computing steps without the use of reasoning. The conceptual Discourse deals with learners' participation in their understanding of the mathematics. Furthermore, the nonmathematical Discourses are subdivided into two categories: regulatory Discourse and contextual Discourse. As the term suggests, regulatory Discourse is mainly about how the teacher controls the class or regulates the behaviour of the learners. Contextual Discourse is interaction involving the context, rather than the mathematics, of a mathematical task.

2.6 Conceptual framework

Based on the literature reviews, we have developed a conceptual framework that outlines the elements contributing to the language used in primary school mathematics classroom discourse (see Figure 2.1).

The conceptual model is adapted to fit the primary school mathematics curriculum in Malaysia. Featuring in this model is three major components that influence the classroom discourse. These are the teacher component, the pupil component and the Discourse. The teacher component is dependent on teacher's language proficiency between mother tongue and English, the types of school and also the number of years in teaching the primary school mathematics. Likewise the pupil component is dependent on pupils' language proficiency and the types of school. Additional element that influences this component is pupils' academic ability which is classified by good and weak classes. The Discourse (uppercase D) is

distinguished by the mathematical and nonmathematical Discourse. Within each category are the procedural and conceptual as well as the regulatory and the contextual Discourses. Table 2.1 briefly describes each component embedded in the model.

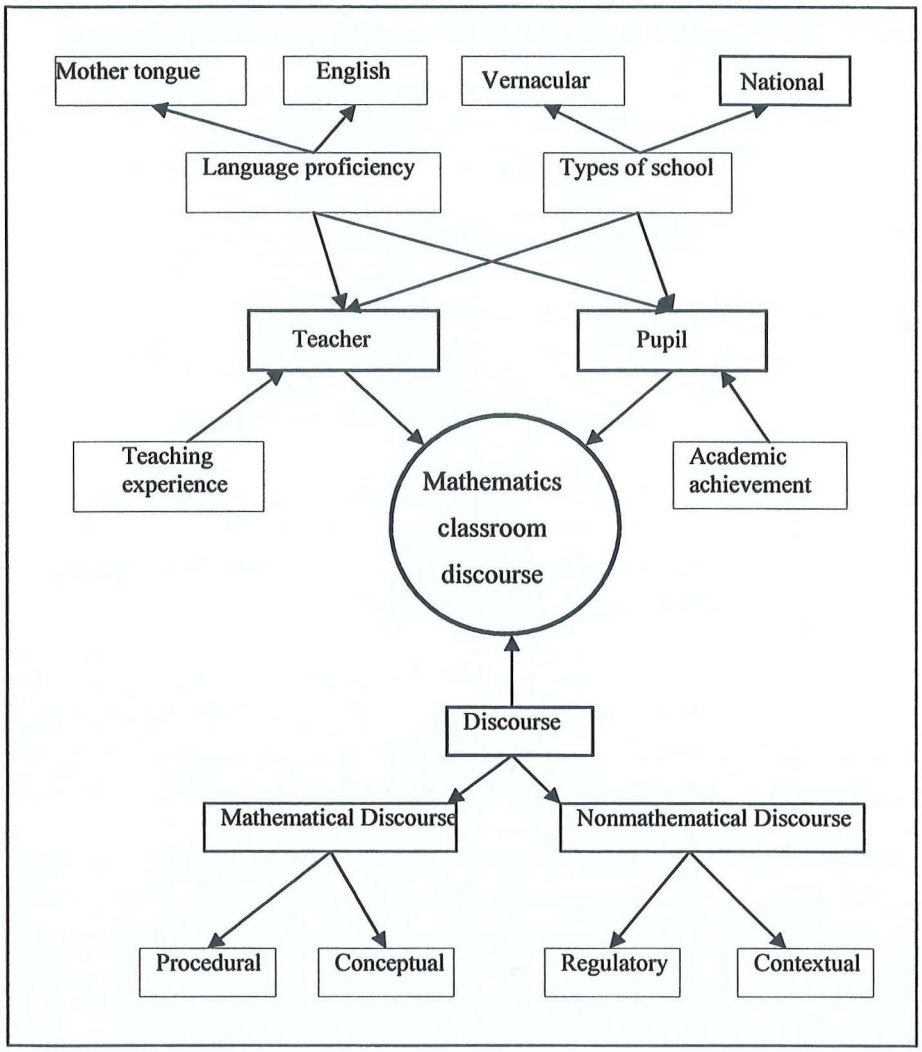

Figure 2.1. A conceptual model of communication and language use in mathematics classroom discourse

Table 2.1
A brief description of the terms used in the conceptual model

Term	Description
Mother tongue	Refers to the Malay language, Mandarin or Tamil.
Language proficiency	Measures the word count in the utterance in mother tongue or English.
National school	Refers to the primary schools that use English only as the medium of instruction in mathematics.
Vernacular school	Referring to the Chinese and Tamil primary schools that use English and Mandarin or English and Tamil as mediums of instruction in mathematics.
Teaching experience	Distinguishes between novice and expert teachers.
Academic achievement	Differentiates pupils into good and weak classes as assigned by the school.
Discourse	Defined as "ways of being in the world, or forms of life which integrate words, acts, beliefs, attitudes, social identities, as well as gestures, glances, body positions and clothes" (Gee,1996, p. 127).
Procedural Discourse	Doing mathematics by following some computing steps without the use of reasoning.
Conceptual Discourse	In doing mathematics, learners "share, discuss, reflect upon, and refine their understanding of the mathematics that is the focus of the interaction" (Setati, 2005, p. 449).
Regulatory Discourse	Looks at how the teacher controls the class or regulates the behaviour of the learners.
Contextual Discourse	Examines the interaction involving the context, rather than the mathematics, of a mathematical task.

Chapter Three

METHODOLOGY

3.1 Introduction

This chapter consists of four sections. The first section provides a brief description of the research design and the second section presents a description of the participants of the study. The third section describes the methods of data collection and the final section presents the methods of data analysis.

3.2 Research design

This study employed a case study research design for two main reasons. Firstly, according to Gall et al. (2003), case study research has four main characteristics: "(1) the study of phenomena by focusing on specific instances, that is, cases; (2) an in-depth study of each case; (3) the study of a phenomenon in its natural context; and (4) the study of the **emic** perspective of case study participants" (p. 436). Secondly, according to Merriam (1998):

> "The case study offers a means of investigating complex social units consisting of multiple variables of potential importance in understanding the phenomenon. It offers insights and illuminates meanings that expand its readers' experiences. ... Because of its strengths, case study is a particularly appealing design for applied fields of study such as education. Educational processes, problems, and programs can be examined to bring about understanding that in turn can affect and perhaps even improve practice " (p. 41).

This case study employed an interpretative research approach for which qualitative data were collected with the intention of analysing and interpreting about the kind of language use and its functions in mathematics classroom discourse (Merriam, 1998).

3.3 Participants

The participants of this study comprised six primary mathematics teachers and 325 primary school pupils selected from the three types of primary schools in Penang state, namely National School (SK), Chinese Vernacular School (SJKC), and Tamil Vernacular School (SJKT). Two mathematics teachers, that is, an experienced teacher (more than 10 years of teaching experience) and a novice teacher (less than 5 years experience) were selected from each type of the primary schools. The number of years of teaching experience of the six teachers ranged from half a year to more than 20 years. T3 who taught primary school mathematics for more than 20 years in the Chinese vernacular school was the most experienced teacher among the six teachers. In addition, she was awarded "Excellent Teacher" by the Ministry of Education in recognition of her significant contribution to mathematics education. In contrast, T2 who taught in the National School only had six months of teaching experience in primary school mathematics. Moreover, two of the

teachers from the National School were novice teachers with less than 5 years of teaching primary school mathematics. Each of the six mathematics teachers selected two classes from the upper primary level, namely Year 4 to Year 6. Based on the overall academic achievement of the pupils, the classes were assigned as "good" for high overall academic achievement and "weak" for low overall academic achievement. Therefore, all the six mathematics teachers served as the teacher participants while all their pupils became the pupil participants of the study. The description of the teacher and pupil participants of the study is summarized in Table 1.

Table 1
Description of the teacher and pupil participants

Teacher	Number of years of teaching experience	Gender	Race	School	Class/Enrolment
T1	4 years	Male	Malay	SK	5G/36, 6W/32
T2	6 months	Female	Chinese		4G/29, 4W/33
T3	>20 years	Female	Chinese	SJKC	4W/26, 4G/39
T4	3 years	Female	Chinese		5W/13, 5G/41
T5	<5 years	Female	Indian	SJKT	6G/26, 6W/12
T6	>10 years	Female	Indian		5G/18, 5W/20

G = Good class W = Weak class

3.4 Data collection

The data of this study were collected mainly through video-taped mathematics lessons and in-depth interviews with the mathematics teachers after the lessons. Two mathematics lessons taught by each teacher were observed, that is, one lesson in a good class and one lesson in a weak class. On average, the time interval of each observed lesson was 40 minutes. Two video-cameras were used to record these lessons. The first video-camera focused on the teacher and captured his/her teaching and actions in the class. The second video-camera was stationed in front of the class at the right hand corner to capture the pupils' activities during the teaching and learning process. The video-recorded mathematics lessons captured by the first video-camera were transcribed verbatim for detailed analysis while the audio and video images captured by the second video-camera were used mainly to aid the transcribing of the video-recorded lessons captured by the first video-camera as well as to clarify any ambiguities in the video-recorded lessons.

The teachers were interviewed immediately after the observed lessons to identify the roles and purposes of language used in the lessons. The protocol used for the in-depth interview with individual teacher is attached in the Appendix. There were seven main questions asked in the in-depth interview. The first, second and third questions were on the teacher's language

used in explaining, questioning and discussing mathematics respectively. The fourth question was on the teacher's language used to argue with their pupils. The fifth question was on the language normally used in the communication between teacher and pupils when the pupils encountered problems. The sixth question was based on the teacher's observation of the pupils' language used in their communication with each other. The final question was on the teachers' language used when they communicated with their colleagues. Besides these seven questions, several additional questions were usually asked by the interviewer in order to obtain further and more detailed information.

At the end of the study, a total of twelve lessons and teacher interviews were recorded and transcribed for detailed analysis. Besides the utterances of the teacher and pupils, the transcripts contained brief descriptions of their actions, such as "teacher distributes worksheet to students' and 'students come out to write their answers on the blackboard."

3.5 Data analysis

The data collected were analyzed using both quantitative and qualitative methods. For quantitative analysis, the transcripts were first cleaned up by removing all the descriptions and unimportant punctuation marks so that they only contained the teachers' and pupils' utterances. Rowe (2004) defined an utterance as "a unit of analysis of speech that corresponds to any uninterrupted stretch of speaking by one or more people" (p. 79). Based on Rowe's (2004) definition, the cleaned transcript of each lesson was then coded according to teacher's and pupils' utterances. Next, the utterances were coded according to math and non-math talk. Math talk was defined as any classroom discourse involving a mathematical context in which concepts are discussed, explained, and queried while non-math talk was defined as talk that does not have mathematics content or context. Examples of non-math talk are greetings, instructions for classroom management and the giving of praises by the teacher. Finally, the utterances were coded according to the language(s) used, that is, whether the utterances were in the mother tongue or English. All the codes were then presented in terms of the percentage of coverage in the mathematics lessons observed.

For qualitative analysis, both the video-recorded lesson transcripts and the interview transcripts were analysed using Nvivo 8 for the following purposes: (i) to identify the roles and purposes of language used for each kind of discourse (questioning, explaining, representing, discussing and conjecturing); (ii) to identify when and why if there is a switch of language used or code-switching for each kind of discourse.

Lastly, a cross-case analysis was carried out to compare the differences in languages used between the expert and novice mathematics teachers as well as between different types of primary schools.

Chapter 4

FINDINGS AND DISCUSSION

4.1 Introduction

This chapter discusses the findings based on both quantitative analysis of the 12 video transcripts and qualitative analysis of the interview data with the six participating mathematics teachers. The discussion will be framed corresponding to the three major research themes of the study: language used, roles of language and mismatch of language used between teachers and pupils.

4.2 Language used by teachers and students in a mathematics classroom discourse

As mentioned in Chapter 3, the twelve video-recorded mathematics lessons were transcribed and analyzed quantitatively to identify the language used in each mathematics lesson. Since the 12 mathematics lessons came from three different types of primary schools namely, a National School (SK); a Chinese Vernacular School (SJKC) and a Tamil Vernacular School (SJKT); and divided into good and weak classes, these lessons were analysed and compared by type of school and type of classes. The good or weak classes were nominated by the participating mathematics teacher based on their personal judgment and perceived pupils' achievement in mathematics and language.

Table 4.1 displays a comparison of the language used and its percentage of coverage in each mathematics lesson observed in each type of primary school. "G" denotes good or better performing class while "W' denotes weak or less performing class. The number refers to the grade level. Thus, "4G" represents Grade 4 better performing class while "5W" refers Grade 5 less performing class.

The total figures are not 100% because other than utterances the transcript contains symbols such as punctuation marks and time of utterance which have not been coded. Blanks indicate that there were no utterances coded in the categories concerned.

(a) A comparison of language used by mathematics teachers and students among the different types of primary schools, and between good and weak classes

Table 4.1 shows that all classes except 6G of the SJKT used two languages in their mathematics classroom discourse. While the Chinese Vernacular School used English and Mandarin, the Tamil Vernacular School used English and Tamil, likewise the National School used English and Malay in their classroom discourse. This is not a surprising result as English is not the first language of the large majority of Malaysian teachers and students. In fact, this result confirmed the findings of Lim, Fatimah and Tang (2007) that only 11% of the mathematics teacher respondents claimed that they taught mathematics entirely using English language. More than half of their mathematics teacher respondents espoused that they used other languages (such as Mandarin, Malay or dialects) in more than half of their mathematics teaching time.

Table 4.1
A comparison of the language used and its percentage of coverage in each mathematics lesson observed

Type of school	Teacher	Class	Percentage of language used (%)				
			English	Mandarin	Tamil	Malay	Total
SK	TN1	5G	82.91			17.09	100
		6W	99.40			0.60	100
	TN2	4G	99.37			0.63	100
		4W	98.58			1.42	100
SJKC	TE3	4W	51.83	48.17			100
		4G	97.57	2.43			100
	TN4	5G	99.50	0.50			100
		5W	46.31	53.69			100
SJKT	TN5	6G	100.00				100
		6W	94.21		5.60	0.19	100
	TE6	5G	99.53		0.47		100
		5W	98.59		1.41		100

SK = National School; SJKC= Chinese Vernacular School ;
SJKT= Tamil Vernacular School
T = Teacher; N = Novice ; E = experienced
G = good class W = weak class
4, 5, 6 = Years 4, 5, 6

As shown in Table 4.1, when good and weak classes were compared, there was an observed difference in the percentage of English language used. For all the three grade levels, English was used as the medium of discourse in more than 72% of the mathematics classroom discourse in the good classes but only about 40% in the weak classes. For the weak classes in the Chinese Vernacular School, English and Mandarin were used in quite equal proportions. However in the good classes Mandarin was used significantly less compared to English. In the National School, although both English and the Malay Language were used, English was the predominant language. In the Tamil Vernacular School, English, Tamil and the Malay Language were recorded in the mathematics classes. In the good class T6G only English was used. More Tamil was recorded for the weak classes. Perhaps we expect students in the good or better performing classes to be also better in English language; hence teachers can use more English language rather than the mother tongue to teach mathematics.

In general it can be observed that English emerged as the main language of instruction and interaction in the mathematics lessons above. The only exceptions were the two weak classes in the Chinese Vernacular School where the use of Mandarin was quite significant (43.5% to 47.36%). There seemed to be efforts by teachers and pupils to adhere to English which was the official language of instruction but not the mother tongue of both teachers and pupils. Later sections will show examples of how English was used in these lessons (see section 4.3)

(b) A comparison between languages used by expert and novice mathematics teachers

Since there was difference in the language used in mathematics classroom discourse between good and weak classes, we are interested to see if there is similar difference in the language

used between experienced and novice teachers. In this study, each participating teacher, whether experienced or novice, taught one good and one weak class of the same grade level. As displayed in Table 4.1, both experienced and novice teachers used more English language in good classes than in weak classes. This result implies that the language used in mathematics classroom discourse is determined more by the pupils' language abilities rather than the teachers' number of years of teaching experiences. This implication is reasonable because the medium of instruction is merely a tool of communication while the main aim of mathematics teaching is to transmit mathematical knowledge, concepts and skills. Hence, to ensure meaningful or effective teaching, the teacher must uses the language best understood by the students to teach and to explain.

4.3 Roles of language in mathematical communication

To examine the roles of each language used, we analyzed the teacher and student interview data. All the six mathematics teachers were interviewed immediately after the classroom teaching observations. During the interview, each teacher was asked which language was used in explaining and questioning the students; as well as when discussing with their fellow colleagues.

Language use for explaining

When interviewed, both teachers of the Chinese vernacular (SJKC) school mentioned that they used English language to explain in good classes but code switch between English and Mandarin for weak classes. For instance, the experienced teacher, TE3 said,

"*Usually for good class, I will use English. And then for weaker class, I will use Mandarin [to] explain first, make sure they understand, and then I will use English.*"

Her opinion was supported by the novice teacher (TN4) that,

"*如果是好的班我会尽量用英语来解释。然后差班就尽量用华语*" [If it is a good class, I will try my best to use English to explain; if weak classes, I will try to use Mandarin.]

Similar preference and role of language used for explanation was also echoed during the interview with the two teachers from the Tamil vernacular (SJKT) school.

TN5 : *So that's why maybe like...weak students I use the what..the... Tamil and...good students I use the ... what...English but sometimes I use the...but...what... Tamil also-lah.*

Interviewer: *Ok. So when you say sometimes, when is the time that you have to use?*

TN5: *if they don't know, don't understand about that...then I explain with Tamil.*

The above conversation shows that these teachers perceived that pupils from the weaker classes are weak in English language proficiency. Hence, they fall back to use mother tongue to explain mathematical concepts so that their weak pupils can understand.

In comparison, for the National School (SK); which had two mathematics teachers involved, one was a Malay and one was a Chinese. The Malay mathematics teacher (TN1) who share

the same mother tongue with the students tended to speak more in Malay while the Chinese mathematics teacher (TN2 whose mother tongue was not Malay) tended to speak more in English with her students. The following interview exchange illustrates the stance:

Interviewer: *When you are teaching or explaining...in your math class, which language do you prefer to use?*

TN1: *Ah, mostly Bahasa Melayu.*

Interviewer: *How about you?*

TN2: *For me I prefer to teach in English, let say if they don't know also I speak less English, just that we show them more example, if they don't really know, so maybe I translate a bit in Malay. So I prefer to speak English.*

In brief, we observed that teachers' cultural background such as their ethnicity and mother tongue may be a factor in their preference in language used in instruction. Teachers whose mother tongue same as their pupils may tend to use the mother tongue more than those who do not share the same cultural background. This preference is particularly obvious when dealing with weak students. This is plausible since the main aim of the language used by both teachers and pupils is for communication. If teachers are confident that their pupils can understand better in mother tongue, certainly they will attempt to explain in mother tongue. In fact, this is a logical tendency as most teachers in several studies (see e.g. Alder, 2001; Setati, 2005) believe that pupils in bilingual or multilingual classroom can learn better when they are taught in their home language or mother tongue.

Language use for questioning

Questions play an integral role in teaching and learning. Teachers ask students questions so as to stimulate student thinking and learning, as well as to assess students' understanding of the lesson taught. Students ask questions so as to clarify doubts or to find out more information about something that they are learning. Hence, the language used by both teachers and students must be matching for effective questioning and interaction.

Both the expert (TE3) and the novice (TN4) mathematics teachers from the Chinese vernacular school espoused similar trend that for good classes, questions were asked in English, but for weak classes, their strategy was "*我会先用英语，那么呢，英语问了过后，如果他们没有反应的话，我会用华语*" [I will use English first, after I ask in English, if they (the students) have no response, then I will use Mandarin]。

Likewise, the two Tamil mathematics teachers (TN5 and TE6) also adopted the same approach of: "*first, I ask in English. If some of them don't know I will explain [ask] in their mother tongue*". However, when come to answering their teacher's questions, these teachers observed that, "*the good one (student), they can answer in English, but the poor one in Tamil*".

On the other hand, when asking questions to their teachers, pupils from all the three schools seemed to show similar trend, that is, students would usually asked questions using their mother tongue except mathematical terminology such as "percentage" or "cm" would be in English.

However, when answering pupils' questions, teachers from different types of school have different approaches. Mathematics teacher (TN4) of the Chinese vernacular school preferred

to answer in English, "*学生问问题的话，我通常会以英文来回答*" [When students asked questions, I used to answer in English]. For the national school, both teachers mentioned that they would answer in English to students from the good classes, but code-switch or use more Malay language than English to students in weak classes.

The above analysis indicates that these teachers tried to abide to the language policy by asking and answering questions in English. However, once English language fails to play its role as a tool of communication, these teachers have no choice but to switch to mother tongue. This phenomenon is particularly obvious in weak classes.

Language use for discussing with peers

In this section, we discuss the language use for discussion in two aspects:

(i) Language used by pupils to discuss with their peers

During the interview, we also asked the teachers what language did they observe their pupils used when discussing with their peers. One of the Chinese vernacular school teachers, TN4 elaborated,

> *For the good class, some of them they can use English to argue, maybe they use the words ...they don't know how to express, but sometime....in between, they will use Chinese. Then for the others, maybe for the good class, half of them they can use English, the other half maybe they just keep quiet and then they prefer to use the Chinese. They can understand, but orally, they are quite weak in oral.*

The above observation shows that in the Chinese vernacular school, more than half of the pupils from the good classes would attempt to speak in English or code-switch between English and Mandarin. Nonetheless, pupils in the weak classes were mainly communicating with their peers using their mother tongue. Similar trend was observed for Tamil school pupils:

> *very good students still use a bit of English to discuss with each other, but majority of the students will use their mother tongue, Tamil to discuss with their peers except mathematical terms (in English).*

The same tendency was also observed in the National school (SK), as TN1 explained,

> *Communication in BM. Ahh...contohlah, for example: Macam mana nak buat ini? Then the friend will say: this one...yang ni you additionlah, you...Mixed the...both the language. You add then you see...tengok difference, difference mean kita kena apa, kita kena substractionkan.* [Communication in Malay, ah, example, for example: How to do this? Then the friend will say: this one ... this one you add, you... mixed the ...both the languages. You add then you see... see difference, difference mean we have to do what, we have to subtract.]

Likewise, pupils from the SK school also tended to use their mother tongue, Malay to discuss with their peers, but they would code-switch to English when come to specific mathematical terminology such as "addition", "subtraction".

In sum, for the majority of these Malaysian primary pupils, English is still not their primary language of communication. Many felt more confident and more comfortable to discuss with their peers using their mother tongue, rather than English. However, for those who are a bit

more confident with their English language proficiency, they will try to communicate in English even though they will usually code–switch with their mother tongue.

(ii) Language used by teachers to discuss with their peers

During the interview, we also asked the teachers what language they used to converse with their fellow colleagues in their staff room conversation. The finding was interesting. There were some differences between the three types of primary school mathematics teachers. For the Chinese vernacular school, the mathematics teachers tended to discuss using Mandarin with their colleagues. However, if one of teachers initiates to converse in English then the whole group might switch to discuss in English. TE3 explained the situation:

> *除了，那个老师，他有那个 initiative 啊，要讲英语，那么我们就。。。我 try 就用，跟他用英语解释。啊，不然的话，我们通常都是用华语交谈。*
>
> [except, when that teacher, he has that initiative, want to speak in English, then we will.. I try to use English to explain to him. Or else, we often use Mandarin to converse.]

In contrast, the Tamil primary mathematics teachers appeared to use more English in their daily conversation with their colleagues, particularly when discussing mathematical problems. Nevertheless, for those who were less proficient in English, they tended to speak more Tamil and limit English to mathematical terms.

In the national primary school, the language choice seems to be influenced by the ethnicity of the speakers. If a Malay teacher meets up with a non-Malay teacher, then the conversation is usually a mixture of English and Malay. If a particular teacher initiates the conversation in English, then both will converse in English. However, if a Malay teacher meets up with another Malay teacher, then depending on the English language proficiency of the speaker, if one of them is weaker, then the other will communicate in Malay to make the communication more comprehensible and non-threatening for each other. The following conversation illustrates the phenomenon:

> Interviewer(I): with your friends, like fellow teacher, when you talk about math, what do you…what language do you use?
>
> Teacher (TN1): Mixed up-lah.
>
> Teacher (TN2): Mix.
>
> I: When you have a math problem and talk to a Malay person, the teacher, so you use Bahasa Melayu?
>
> TN1: Depend to the…teacher...the…person.
>
> I: Oh?
>
> TN1: Let say sometime I speak with Ms TN2.
>
> I: Because you all usually speak in English.
>
> TN1: we just use English, but there are other teachers.
>
> I: If Malay and Malay teacher…

TN1: Dia...apa...dia punya English tak berapa kuat sangat, so we have to mixed-lah, Malay and English. [His English not so good, so we have to mix, Malay and English]

The above result indicates that even among the teachers, English was spoken only selectively. Perhaps we should not be surprised to observe that the pupils in these bilingual classrooms did not converse much in English.

4.4 Any mismatch of language used between teachers and pupils?

The mismatch between teachers and pupils in the mathematics classroom discourse is discussed in terms of the pupil talk/teacher talk dichotomy and math talk /non-math talk dichotomy. The findings described below are based on the recordings of 12 mathematics lessons (that is, one lesson per class) across three types of primary schools.

In Table 3 we try to differentiate between math talk and non-math talk as well as teacher talk and pupil talk. In other words, the table shows who did the most talking in the mathematics lessons observed and what was the proportion of mathematics content within the overall discourse.

Table 4.2
Proportions of math talk and non-math talk by teachers and pupils

	Math talk (%)			Non-math talk (%)	
	Teachers	Courseware	Pupils	Teachers	Pupils
C4W	46.62	1.72	13.64	24.31	5.27
C5W	63.70	6.66	8.09	11.46	0.56
C5G	54.62		11.97	22.96	0.96
C4G	59.85	2.71	8.35	19.12	2.27
T5G	35.89		20.48	32.89	0.99
T5W	51.12		11.86	24.69	1.68
T6G	32.37		16.73	32.35	11.00
T6W	32.55		10.13	32.52	15.43
N4Wa	50.55		24.27	6.48	6.37
N4Wb	23.45		27.55	14.97	14.65
N5G	54.77		13.94	18.18	1.27
N6W	58.02		16.42	14.80	0.46
Mean	46.96	0.92	15.29	21.23	5.08

As given in the table above, there was more math talk compared to non-math talk. In the Chinese Vernacular School, part of the discourse came from an interactive courseware prepared by the Ministry of Education to help teachers conduct their lessons in English. The teachers concerned presented the lesson from a CD and pupils responded to the voice and picture stimuli used to teach a mathematical concept.

In addition classroom talk was dominated by the teacher (46.96% + 21.23%) when compared with the pupils (15.29% + 5.08%), whether in the form of math talk or non-math talk. The two Indian teachers (one teaching T5G and T5W, the other teaching T6G and T6W) seemed to engage in more non-math talk. Excerpts later will show that where pupil input was high (for example N4Wb), it was generally confined to procedural Discourse with pupils repeating after the teacher to reinforce the use of mathematical terms and procedures. The prominent role of the teacher in contrast to the submissive role of the pupils was not surprising as teacher-centredness is quite typical of the examination oriented Malaysian classroom. The flow is one-way with the teacher transmitting knowledge and pupils receiving it unquestioningly. Pupils rarely see themselves as playing an active role in the co-construction of knowledge in the classroom. Elements of teacher dominance and power relations in the mathematics classroom are highlighted in the following six excerpts.

Excerpt 1

This lesson in N4Wb (a National School Year 4 weak class) was an introduction to the various denominations of the Malaysian currency. Pupils' utterances are in italics and mother tongue is in bold. Explanatory notes are in round brackets while translations are in square brackets.

Teacher T2:	Spell thousand.
Pupils:	*T-h-o-u-s-a-n-d, thousand*
T2:	Spell thousand. In front of Madihah. (Teacher asks someone in front of a pupil by the name of Madihah to spell the word.)
	Class, again, spell thousand.
Pupils:	*T-h-o-u-s-a-n-d, thousand*
T2:	Again.
Pupils:	*T-h-o-u-s-a-n-d, thousand*
T2:	Again.
Pupils:	*T-h-o-u-s-a-n-d, thousand*
...	
Pupils:	*Teacher* (A pupil seems to have a question regarding the task given on the board.)
T2:	Ok, **duduk depan.** [sit in front]
Pupils:	*Teacher,* ***perlu lukis?*** [Need to draw?]

T2: **Dah cakap, tak payah lukis** [I have already said there is no need to draw]. At the back, can you see? Can you see? **Nampak tak**? [Can see?] **Tak nampak**? [Cannot see?] Ok, go in front.

Pupils: *Teacher* (A pupil has the same question.)

T2: **Tak payah.**[No need] (Teacher answers the pupil's question.)

Boleh nampak? [Can see?] (Teacher again addresses the whole class.)

The first part of the lesson shows a drill on the pronunciation and spelling of the word "thousand." Pupils' responses were regular and mechanical, generally without variation. The focus on language rather than mathematics is apparent in this entire segment. This type of pupil input also accounted for the fairly high proportions in percentages of pupil talk in English.

The second part of the lesson which consisted of non-math talk shows more variability and communication. The teacher and pupils used both English and the Malay Language. After writing a task on the board the teacher was concerned that the pupils could read the task clearly. The pupils were more worried about whether to "draw" the diagram or not and repeatedly tried to ask the teacher for a clear instruction on that. The pupils probably feared being sanctioned if they did the wrong thing. Another interesting feature in the excerpt is the teacher on many occasions translated immediately her instructions given in English.

These patterns of interaction are very common in the lessons recorded in the National School. In such lessons we argue that English did not play a significant role in the teaching and learning of mathematics. English was important as the language of mathematical terms while the Malay Language was apparent in non-math talk in the regulatory Discourse.

Excerpt 2

This lesson on "averages" took place in T5G (a Tamil Vernacular School Year 5 good class).

T4: Ok. Now, just now you do isn't it? Combine all the pencil and then divide... (Teacher's cue for the pupils to repeat after her.)

Pupils: *divide*

T4: Ok. That is the average. That is the average... (Teacher's cue for the pupils to repeat after her.)

Pupils: *average*

T4: Find the average what you must do?

Pupils: *Plus and divide*

T4: Plus and ...?

Pupils: *divide*

T4: All of you read again.

Pupils: *average, total of quantity, number of quantity*

T4: Here teacher give a example. Now you find the average ok? And tell me the answer. Can or not?

Pupils: *can*

The teacher in the above excerpt is like a choir director. She questioned and controlled the pupils' answers, most of the time expecting only a one word answer or pupils to repeat after her. Pupil math talk was basically about repeating after the teacher. Although English was used it was limited to procedural and regulatory Discourses rather than conceptual Discourse.

Excerpt 3

The following excerpt from a lesson in T5W (a Tamil Vernacular School Year 5 weak class) shows the same Indian teacher giving feedback to a group activity to reinforce the understanding of "averages". The letter t in bold represents utterances in Tamil.

T4: ok, what they do?

Pupils: *Plus*

T4: Plus. What they did, do? They combine the pencils first and then…

Pupils: *divide*

T4: Divide with what?

Pupils: *Three, Two*

T4: Ah? three?

Pupils: *Two*

T4: Here only 2 persons is it? Ha… divide in 2.

What you understand about this?

ttttttttttttttttttttttttttttttttttttttttttt [divide equally] Gemeran? (Teacher poses a question to a student by the name of Gemeran.)

Pupil: ***ttttttttttttttttttttttttttttt*** (pupil's reply in Tamil but not clear enough to be transcribed)

T4: Ok, this is the average. They combine the total, the things and divide equally. Ok, give a clap.

The excerpt above is mainly in English. Tamil is used when addressing a student by the name of Gemeran who seems to encounter some difficulty with the concept. This lesson shows procedural, conceptual and regulatory Discourses. Initially the teacher participated in procedural Discourse as she revised the steps of "plus" and "divide". Next her reasoning with "Here only 2 persons is it?" is engagement in conceptual Discourse. She finished the portion of the lesson by restating the procedures. Finally "Ok, give a clap" shows her participating in the regulatory Discourse as she directs her pupils to acknowledge the presentation of the group.

Excerpt 4

The following excerpt is taken from the lesson in T6G (a Tamil Vernacular School Year 6 good class). This song was created by another Indian teacher (T3) and sung using the tune of "Are you sleeping?" The lyrics were put up on a powerpoint slide. This teacher also repeated the lesson in T6W.

T3:	Today we are going to… sing a song. This song you must use the tune of "Are you sleeping". Ok, anybody, start the…song? Anybody can start the song? Lashini (a girl's name). You know "Are You Sleeping"?
Pupils:	*Yes*
T3:	The song "Are You Sleeping?" You know or not? (Teacher addresses the whole class). You can use the tune, ok?
Pupils:	(Pupils try to sing the song with the new lyrics.) *Who wants a cake? Who wants a cake?* *Here you are, here you are.* *It's a large cake, it's a large cake.* *Divide by eight, divide by eight.* *Arr..are you happy? Are you happy?* *Eat a cake, eat a cake.* *Do you want one more? Do you want one more?* *Yes you can, yes you can.*

Earlier in Table 3, T6G and T6W show relatively higher percentages of non-math talk (11.00% and 15.43% of total discourse) compared to all the other classes. The figures were due to the repeated singing of the song above which was used as an induction set for the topic on fractions. This is an example of contextual Discourse accomplished in English. The rest of the lessons observed in this school showed the pupils supplying one word answers and repeating after the teacher in a teacher-directed classroom.

Excerpt 5

This excerpt is taken from a lesson in C5G (a Chinese Vernacular School Year 5 good class). This segment is entirely in English, a practice by this Chinese teacher (T2) with the good classes.

T2:	So, since that you all already know how to convert kilogram to gram, so, before stop our lesson, I want to ask. Ok, if we want convert kilogram to gram, we have to…(Teacher cues pupils to supply the answer.)
Pupils:	*multiply*
T2:	Kilogram to gram.
Pupils:	*multiply*
T2:	Har…we have to multiply 1000. (Teacher cues pupils to repeat after her.)
Pupils:	*multiply 1000*

T2: If we want to convert gram to kilogram?

Pupils: *divide by 1000*

T2: So, 1 kilogram is equal to

Pupils: *1000 gram*

The excerpt shows some cueing by the teacher to ellicit brief pre-determined answers. The lesson was teacher-centred and pupils did not seem to be encouraged to ask questions. The procedural Discourse dominates this excerpt.

Excerpt 6

In a weak class C5W the same teacher employed a lot of translations as seen below. Translations are given in square brackets.

T2: Today, before we go to our lesson, I want to ask you all. What is the unit, you use to measure the mass for the heavy object like rice, sugar, watermelon, and other thing? Who knows? Who can tell me? What is the unit you use, to measure the mass of heavy object? 你们用什么单位来测量，比较重的东西？ [What is the unit you use to measure the mass of heavier objects?] Who knows? Who can tell teacher? Who want to try? Who want to try? 来，谁可以讲试试看，我们用什么单位来秤比较重的东西？好，健良。 [Come, who can try, what is the unit we use to measure the mass of heavier objects? Okay, Jian Liang (a boy's name)] Yes?

Pupil: *km*

T2: km? 不对，有谁要试试看？ [Incorrect, who wants to try?]

Pupils: *Sugar*

T2: Huh?

Pupils: *Sugar*

T2 Sugar 好。不是啊。我们呢，我们如果要秤，秤啊，糖有多重，那么，我们是用什么单位来测量的？ [Ok, no. We, if we want to measure, measure how much sugar weighs, then what is the unit we use to measure the mass?]

Pupils: *kg*

T2: kg… correct, kg. We will use, kg. To measure the mass for the heavy object arr... 那么我们是用 kg 啊 [then we use kg]，kg 呢 [chinese expression with no particular meaning] stand for kilogram.

The exchange above shows the pupils had either not grasped the meaning of the unit of measurement or misintepreted the teacher's question of "What is the unit you use, to measure the mass of heavy object?" The teacher had to rely heavily on translation into the mother tongue. The procedural Discourse above concerned the use of the appropriate unit, i.e.

kilogram, to measure the mass of heavy objects. The excerpt ended with the teacher stating that "kg...stand for kilogram," showing the preoccupation with terminologies in English. Pupils' responses were one-word answers in English, an indication of their lack of proficiency in the language.

On the whole, language use in the mathematics classrooms in the three primary schools was largely related to the ethnicity of the pupils in the schools. Together with English, Mandarin was used in the Chinese Vernacular School, Tamil in the Tamil Vernacular School and the Malay Language in the National School. The pupils' mother tongue was an invaluable language to fall back on for the teaching and learning of mathematics.

At a more detailed level, the analysis above highlighted four types of Discourses, namely, regulatory, procedural, conceptual and contextual Discourses. Across the four types of Discourses English was used in various proportions. English was the language of procedural Discourse as there seemed to be a general concern for terminologies and procedures. The pupils' mother tongue was used for non-math talk in regulatory Discourse. We can imagine a continuum with procedural Discourse and regulatory Discourse at either ends. As English use decreased mother tongue use increased. Between these two ends of the continuum, conceptual and contextual Discourses are located, with varying proportions of English and mother tongue use. Given the level of English proficiency of teachers and pupils, the mother tongue played a major role as the language of conceptual Discourse which requires reflection and the articulation of one's reasoning.

Chapter 5

CONCLUSION AND IMPLICATIONS

5.1 Introduction

The purpose of this study is to identify the kind of language used and its functions in mathematics classroom discourse. This chapter comprises four sections. The first section presents the summary of findings and the second section discusses the implications from the findings of the study. The third section describes the limitations of the study and the fourth section provides recommendations for further research. Finally, a conclusion makes up the last section of this chapter.

5.2 Summary of findings

(a) Language used by teachers and students in mathematics classroom discourse

Analysis of the data showed that eleven out of the twelve classes mainly used two languages (English and the mother tongue of the students) in their mathematics classroom discourse, that is, the Chinese Vernacular School used English and Mandarin, the Tamil Vernacular School used English and Tamil, and the National School used English and Malay. In addition, there was a difference in the language used in mathematics classroom discourse between good and weak classes. In general, for all the three grade levels more English was used in teaching mathematics to the good classes than the weak classes in all the three types of primary schools. However, there was no difference in the language used between expert and novice mathematics teachers. In the mathematics classroom discourse, both expert and novice mathematics teachers used more English in good classes than in weak classes. Thus, the usage of English in a mathematics classroom discourse is determined more by the teachers' confidence in their pupils' level of English language proficiency than their years of teaching experience.

(b) Roles of language in a mathematics classroom discourse

(i) Language use for explaining

Teachers' preference in language used for explaining in mathematics classroom discourse might be influenced by their cultural background such as ethnicity and mother tongue as well as their pupils' level of English language proficiency. Both expert and novice teachers in the Chinese Vernacular School, and the Tamil Vernacular School explained in English for good classes but explained in English and Mandarin, and in English and Tamil for weak classes respectively. But, in the National School the Malay mathematics teacher tended to explain in Malay while the Chinese mathematics teacher tended to explain in English. It seems that teachers whose mother tongue is the same as that of their pupils tended to use the mother tongue more than those who do not share the same cultural background.

(ii) Language use for questioning

Likewise, teachers' preference in language use for asking questions to pupils in mathematics classroom discourse might also be influenced by their cultural background and their pupils' level of English language proficiency. Both expert and novice teachers in the Chinese Vernacular School, and the Tamil Vernacular School questioned in English for good classes but questioned in English followed by Mandarin, and in English followed by Tamil for weak classes respectively. However, pupils in all the three types of schools preferred to use their mother tongue for asking questions to teacher in mathematics classroom discourse except for mathematical terminology.

(iii) Language use for discussing with peers

The pupils from good classes in all the three types of schools might still try to use English to discuss with each other and code-switched with their mother tongue for mathematical terminology. That is, the Chinese Vernacular School used English and code-switched with Mandarin, the Tamil Vernacular School used English and code-switched with Tamil, and the National School used English and code-switched with Malay. But the pupils from weak classes in all the three types of schools would use their mother tongue to discuss with their peers. It appears that most of the pupils were more comfortable to discuss with their peers in their mother tongue, except when using mathematical terminology. Therefore, English remains as a secondary language for the majority of Malaysian primary pupils.

However, there was a difference in the language used for discussing with colleagues among the three types of primary school mathematics teachers. The Chinese Vernacular School mainly used Mandarin but the Tamil Vernacular School tended to use more English. In contrast, in the National School, the language choice seemed to depend on the ethnicity of the speakers. If both speakers are of different ethnicity, then they most likely speak English to each other. In contrast, if both are Malays, then they might speak in English provided both are fluent in English, or else they will usually speak Malay mix with mother tongue.

(c) Mismatch of language used between teachers and students

Analysis of the data highlighted four types of Discourses, namely, regulatory, procedural, conceptual and contextual Discourses. While English was the main language of procedural Discourse, the pupils' mother tongue played a major role as the language of conceptual Discourse as well as for non-math talk in regulatory Discourse. Thus, the pupils' mother tongue was an invaluable language to fall back on for the teaching and learning of mathematics in all the three types of schools.

Talking mathematics in English is indeed an interesting phenomenon in Malaysian schools. The patterns of use are complex because the discourse in the mathematics classroom manifests the interplay of pupils' and teachers' proficiency in English and the language of assessment arising from a language-in-education policy. An equally important societal force comes from the expectations of parents on the use of English for the teaching and learning of mathematics. This aspect has not been discussed in this study.

5.3 Implications

There are several implications that we can draw from the findings of this study.

First, language use in the mathematics classroom discourse in the three primary schools was closely associated with the types of primary schools or more specifically the ethnicity of the

pupils in the schools. The teachers tended to fall back on pupils' mother tongue to explain, question, discuss or achieve various purposes either in mathematical or non-mathematical Discourses. This kind of teacher language preference was particularly obvious with weak students. This result implies that apart from using English as the sole language of instruction, teachers should be allowed to use the pupils' mother tongue in the teaching and learning of mathematics in order to promote effective and meaningful mathematics classroom discourse in primary schools. For instance, the Chinese Vernacular Schools were allowed to teach mathematics in two languages, namely English and Mandarin, based on the formula of 2-4-3 for the lower primary pupils and 4-2-2 for the upper primary pupils. The 2-4-3 formula refers to two periods of English language, four periods of mathematics in English and three periods of science in English while the 4-2-2 formula refers to four periods of English language, two periods of mathematics in English and two periods of science in English. Hence, upper primary pupils in Chinese Chinese Vernacular Schools now have eight periods of mathematics per week (six in Mandarin and two in English) whereas the lower primary pupils have ten periods of mathematics per week (six in Mandarin and four in English).

In addition, several studies on learning mathematics in bilingual or multilingual classrooms in South Africa have shown that pupils can learn better when they are taught in their home language or mother tongue or first language (L1) (Alder, 2001; Setati, 2005). According to the Developmental Interdependence Hypothesis proposed by Cummins (1979), "there is an interaction between the language of instruction and the type of competence the child has developed in his L1 prior to school" (p. 75). This could mean that if pupils are competent in both their L1 and L2, the teaching of mathematics in two languages could have an additive effect on their cognitive competency in mathematics. Further, more and more recent studies (Gerber, Engelbrecht, Harding, & Rogan, 2005; Clarkson, 2006) have provided evidences that supported Cummins' well quoted hypothesis.

Second, language use in mathematics classroom discourse in the three primary schools was closely related to the level of English language proficiency of both the teachers and pupils. Given the level of English language proficiency of teachers and pupils, English was often used for procedural Discourse whereas mother tongue was the main language of conceptual Discourse. The implication of this finding is that the level of English language proficiency of teachers must be improved as they are the master of mathematics classroom discourse. Longer training courses to equip teachers with appropriate, effective and research-based methods of teaching mathematics in English must be well planned and implemented systematically. The training courses should not merely equip teachers with terminologies as this will result in teachers doing the same thing to their pupils. In addition, if we were to adhere strictly to the PPSMI policy that is mathematics is only taught in English in all the types of primary schools, then the language of assessment used in school and public examinations must also be in only one language, namely English.

5.4 Limitations of the study

The sample of this study is limited to only three primary schools namely, a National School (SK); a Chinese Vernacular School (SJKC) and a Tamil Vernacular School (SJKT) in Penang state. In addition, the participants of this study only comprised six primary mathematics teachers and 325 primary school pupils selected from the three types of primary schools. Further, only 12 mathematics lessons that is two mathematics lessons (one lesson in a good class and one lesson in a weak class) taught by each of the 6 teachers were observed and

video-recorded. As such, we acknowledge our limitations in making any generalizations from the findings of this study.

5.5 Recommendations for further research

The findings of this study represent only 12 classrooms of upper primary pupils taught by six mathematics teachers from three different types of primary schools in Penang state. More studies are needed with larger number of classrooms of lower and upper primary pupils taught by larger number of mathematics teachers from three different types of primary schools in different states of our country in order to verify and elaborate the findings of this study. Further studies might also be conducted to identify the kind of language used and its functions in mathematics classroom discourse in secondary schools.

5.6 Conclusion

In sum, the findings reported in this study highlight the kind of language used by teachers and students in a mathematics classroom discourse, the differences in language use between expert and novice mathematics teachers, the differences in language use by mathematics teachers and students between different types of primary schools, the roles of language in mathematical communication, and the mismatch of language use between teachers and students in a mathematics classroom discourse. We hope these findings will contribute towards producing a theoretical language model that explains the roles of language in enhancing mathematical communication in the Malaysian context. Consequently, this model will be used to further improve the process of teaching and learning mathematics in both primary and secondary schools. Lastly, it is our hope that the findings of this study will provide some baseline data for the policy makers in planning effective future mathematics curriculum reform.

REFERENCES

Alder, J. (1998). A language of teaching dilemmas: Unlocking the complex multilingual secondary mathematics classroom. *For the Learning of Mathematics, 18*(1), 24 – 33.

Adler, J. (2001). *Teaching mathematics in multilingual classrooms.* Dordrecht: Kluwer Academic Publishers

Baker, C. (1993). *Foundations of bilingual education and bilingualism.* Clevedon, Avon, Multilingual Matter Ltd.

Barton, B., & Neville-Barton, P. (2003). Language issues in undergraduate mathematics: A report of two studies. *New Zealand Journal of Mathematics (Supplement), 32*, 19-28.

Bohlmann, C. (2001). Reading skills and mathematics. *Communications: Third Southern Hemispere Symposium on Undergraduate Mathematics Teaching*, 5-14.

Clarkson, P. C. (2006). Australian Vietnamese students learning mathematics: High ability bilinguals and their use of languages. *Educational Studies in Mathematics, 64*: 191–215.

Clement, J., Lochhead, J., & Monk, G. (1981). Translation difficulties in learning mathematics. *American Mathematical Monthly, 4*, 286-290.

Cummins, J. (1979). Linguistic interdependence and the educational development of bilingual children. *Review of Educational Research, 49*(2), 222-251.

Dale, T. C. & Cuevas, G. C. (1987). ESL through content-area instruction. In Crandall, J. Ed.), *Integrating language and mathematics learning.* Engelwood Cliff, New Jersey: Prentice Hall Regents, 9-52.

Gee, J. P. (1996). *Social Linguistics and Literacies* (2nd ed.). London: Taylor & Francis.

Gerber, A. (2004). *The influence of second language teaching and undergraduate mathematics performance.* Unpublished M.Sc. dissertation. University of Pretoria.

Gerber, A., Engelbrecht, J., Harding, A., & Rogan, J. (2005). The influence of second language teaching on undergraduate mathematics performance. *Mathematics Education Research Journal, 17*, 3-21.

Hamidah Ab Rahman, Aziz Nordin, Mukheta Isa, Fatimah Puteh, Faruk Muhammad, Norazman Abd. Majid, Aminah Ahmad Khalid, Siti Fatimah Bahari, Hj Shufaat Tumin & Zurihanmi Zakariya (2005). Teachers' Competency in the Teaching of Mathematics in English In Malaysian Secondary Schools. In Alan Rogerson (Ed.), *Proceedings Of The 8th International Conference: Reform, Revolution And Paradigm Shifts In Mathematics Education,* Johor Bahru, Malaysia, Nov 25th – Dec 1st 2005, Pp. 31-36.

Kaput, J., & Clement, J. (1979). Letter to the editor. *The Journal of Children's Mathematical Behavior, 2*(2), 208.

Lemke, J. L. (1990). *Talking Science: Language, learning and values.* Norwood, NJ: Ablex Publishing Corporation.

Lim, C. S., & Chee, K. M. (2005). *Teaching mathematics in English: Problems and challenges faced by mathematics teachers.* Paper presented at the TED ELTC EteMS Conference 2005: Fostering Schools that Learn, Subang, Selangor, 22-24 November.

Lim, C. S. & Wun, T. Y. (2003). *Teaching Mathematics in English: Are our mathematics teachers ready?* Paper presented at the International Conference on Science and Mathematics Education, organized by University of Malaya, 14-16 October, 2003.

Lim, C. S., Fatimah, Saleh, & Tang, K. N. (2007). *The teaching and learning of mathematics and science in English: The perspectives of primary school administrators, teachers and pupils.* Kuala Lumpur: Centre for Malaysian Chinese Studies.

McLean, A. (2000). The predictive approach to teaching statistics. *Journal of Statistics Education, 8*(3). Retrieved May 28, 2004 from: http://www.amstat.org/publications/jse/secure/v8n3/mclean.cfm

Merritt, M., Cleghorn, A., Abagi, J. O., & Bunyi, G. (1992). Socialising multilingualism: Determinants of codeswitching in Kenyan primary classrooms. *Journal of Multilingual and Multilingual Development, 13*(1 & 2), 103 –121.

Merriam, S. B. (1998). *Qualitative research and case study applications in education: Revised and expanded from case study research in education.* San Francisco: Jossey-Bass Publishers.

Mestre, J. P. (1988). Language comprehension and problem solving. In Cocking, R. R. & Mestre, J. P. (Ed.), *Linguistic and cultural influences on learning mathematics.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc., 221-240.

Moschkovich, J. N. (2002). A situated and sociocultural perspective on bilingual mathematics learners. *Mathematical Thinking and Learning, 4*, 189-212.

Moschkovich, J. N. (2005). Using two languages when learning mathematics. *Educational Studies in Mathematics, 64*(2), 121 – 144.

Moschkovich, J.N. (2007) Using Two Languages When Learning Mathematics *Educational Studies in Mathematics*, 64(2), 121-144. Retrieved March 22, 2010 from: http://math.arizona.edu/~cemela/spanish/content/workingpapers/UsingTwoLanguages.pdf

National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics.* Reston, VA: Author.

Poon, Y. K. (2004). Language policy of Hong Kong: Its impact on language education and language use in post-handover Hong Kong. *Journal of Taiwan Normal University: Humanities & Social Sciences, 49*(1), 53-74.

Rollnick, M. (2000). Current isuues and perspectives on second language learning of science. *Studies in Science Education, 35*, 93-121.

Rosnick, P. (1981). Some misconceptions concerning the concept of variable. *The Mathematics Teacher, 74,* 418-420.

Rosnick, P. & Clement, J. (1980). Learning without understanding: The effect of tutoring strategies on algebra misconceptions. *Journal of Mathematical Behavior, 3*, 3-27.

Rowe, S. (2004). Discourse in activity and activity as discourse. In R. Rogers (Ed.), *An introduction to critical discourse analysis in education.* Mahwah, N.J.: Erlbaum Associates.

Setati, M. (1998). Code-switching in a senior primary class of second-language mathematics learners. *For the Learning of Mathematics, 18*(1), 34-40.

Setati, M. (2002). Researching mathematics education and language in multilingual South Africa. *The Mathematics Educator, 12*(2), 6 –20.

Setati, M. (2005). Teaching mathematics in a primary multilingual classroom. *Journal for Research in Mathematics Education, 36*(5), 447-466.

Setati, M. & Alder, J. (2001). Between languages and discourse: Code-switching practice in primary classrooms in South Africa. *Educational Studies in Mathematics, 43*, 243 – 269.

Sierphinska, A. (1998). Three epistemologies, three views of classroom communication: Constructivism, sociocultural approaches, interactionism. In H. Steinbring, M. G. B. Bussi, A. Sierpinska (Eds.), *Language and communication in the mathematics classroom* (pp.30-64). Reston, Virginia: National Council of Teachers of Mathematics.

Tan, L. E. (2006). *Kesediaan guru sekolah rendah dalam perlaksanaan penggunaan bahasa Inggeris untuk mengajar mata pelajaran sains dan matematik.* [The readiness of primary school teachers in implementing the use of English language to teach mathematics and science subjects]. Unpublished Master of Education project report, Universiti Sains Malaysia.

Thurston, W. P. (1995). On proof and progress in mathematics. *For the Learning of Mathematics, 15,* 29-37.

Tucker, G. R. (1999). A global perspective on bilingualism and bilingual education. *ERIC Digest* (Washington, D.C.), EDO-FL-99-04.

Vygotsky, L. (1978). *Mind in society.* Cambridege, M. A.: Havard University Press.

Yip, D. Y., & Tsang, W. K. (2007). Evaluation of the effects of the medium of instruction on science learning of Hong Kong secondary students: Students' self-concept in science. *International Journal of Science and Mathematics Education, 5*, 393-413.

Zentella, A. C. (1997). *Growing up bilingual: Puerto Rican children in New York.* Malden, MA: Blackwell Publishers.

APPENDIX A

Interview Questions for Teacher

1. What types of language do you prefer to use in explaining mathematics? Why?

   --any difference when explaining between good and weak students?
   -- any difference when explaining difficult or easy concepts/ skills?

2. What types of language do you prefer to use when you ask students questions?

   --any difference between good and weak students?

3. What types of language do you prefer to use when you discuss with your students?

   --any difference between good and weak students?

4. What types of language do you prefer to use when you reason/justify/argue with your students?

   --any difference between good and weak students?

5. When your students have problems, normally what language do they use to ask you? What kind of language do you use to respond?

6. From your observation, what kind of language is used by the students to talk to each other about mathematics?

7. When you discuss mathematics problems with your fellow teachers, what kind of language do you use?

Malay version

1. Apakah bahasa yang anda lebih suka gunakan semasa menerangkan Matematik? Mengapa?

   --apakah perbezaan apabila menerangkan kepada pelajar yang baik dengan pelajar yang lemah?

   --apakah perbezaan apabila menerangkan konsep/teknik yang susah dengan yang senang?

2. Apakah bahasa yang anda lebih suka gunakan semasa menyoal pelajar?

   --apakah perbezaan antara pelajar yang baik dengan pelajar yang lemah?

3. Apakah bahasa yang anda lebih suka gunakan semasa berbincang dengan pelajar?

   --apakah perbezaan antara pelajar yang baik dengan pelajar yang lemah?

4. Apakah bahasa yang anda lebih suka gunakan semasa memberi sebab/membuat pembetulan/ membahas dengan pelajar?

   --apakah perbezaan antara pelajar yang baik dengan pelajar yang lemah?

5. Apabila pelajar anda menghadapi masalah, apakah bahasa yang biasa mereka gunakan untuk bertanya soalan? Apakah bahasa yang anda gunakan untuk menjawab soalan mereka?

6. Daripada pemantauan anda, apakah bahasa yang pelajar anda gunakan semasa bertutur antara satu sama lain?

7. Apakah bahasa yang anda gunakan apabila anda berbincang masalah Matematik dengan guru serakan anda?

APPENDIX B

Focus Group Interview Questions for Pupils

English version

1. Normally what kind of language does your teacher use?
2. What types of language do you prefer your mathematics teachers to use? Why?
   - is it because you can understand your teacher's explanation better?
   - is it because you feel closer with your teacher?
3. When you have problem, do you ask your teacher in your mother tongue or English? Why?
4. What language does your teacher use to answer your question?
5. When you discuss mathematics problems with your friends, what kind of language you used? Why?

Malay version:

1. Apakah bahasa yang biasa guru anda gunakan?
2. Apakah bahasa yang anda lebih suka guru Matematik anda gunakan? Mengapa?
   -adakah ini kerana anda lebih faham tentang penjelasan guru anda?
   -adakah ini kerana anda berasa lebih mesra dengan guru anda?
3. Apabila anda menghadapi masalah, anda bertanya soalan kepada guru anda dengan menggunakan bahasa ibunda atau bahasa Inggeris? Mengapa?
4. Apakah bahasa yang guru anda gunakan untuk menjawab soalan anda?
5. Apakah bahasa yang anda gunakan semasa berbincang masalah Matematik dengan kawan anda? Mengapa?
6.

Chinese version

1. 通常你的老师会使用什么语言？
2. 你比较喜欢你的数学老师使用什么语言？为什么？
   -是不是因为这样你可以比较明白老师的解释？
   -是不是因为这样你觉得和老师比较亲近？
3. 你面对问题的时候，你会用母语或英语向老师发问问题？为什么？
4. 你的老师会用什么语言来回答你的问题？
5. 你和你的朋友讨论数学问题的时候，你会用什么语言？为什么？