

**LANGUAGE PROFICIENCY AND TEACHER
KNOWLEDGE BASES IN THE TEACHING OF SCIENCE
THROUGH ENGLISH**

ASIAH MOHD SHARIF

**FACULTY OF LANGUAGES AND LINGUISTICS
UNIVERSITY OF MALAYA
KUALA LUMPUR**

2013

**LANGUAGE PROFICIENCY AND TEACHER
KNOWLEDGE BASES IN THE TEACHING OF SCIENCE
THROUGH ENGLISH**

ASIAH MOHD SHARIF

**THESIS SUBMITTED IN FULFILMENT
OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF
PHILOSOPHY**

**FACULTY OF LANGUAGES AND LINGUISTICS
UNIVERSITY OF MALAYA
KUALA LUMPUR**

2013

UNIVERSITY OF MALAYA

ORIGINAL LITERARY WORK DECLARATION

Name of Candidate: **Asiah Mohd Sharif** (I.C. No.:**620729-05-5004**)

Registration /Matric No: **THA 070016**

Name of Degree: **Doctor of Philosophy**

Title of Project/Paper/Research Report/Dissertation/Thesis (“This Work”):

Language Proficiency and Teacher Knowledge Bases in the Teaching of Science through English

Field of Study: **Classroom Discourse**

I do solemnly and sincerely declare that:

- (1) I am the sole author/writer of this Work;
- (2) This Work is original;
- (3) Any use of any work in which copyright exists was done by way of fair dealing and for permitted purposes and any excerpt or extract from, or reference to or reproduction of any copyright work has been disclosed expressly and sufficiently and the title of the Work and its authorship have been acknowledged in this Work;
- (4) I do not have any actual acknowledge nor do I ought reasonably to know that the making of this work constitutes an infringement of any copyright work;
- (5) I hereby assign all and every rights in the copyright to this Work to the University of Malaya (“UM”), who henceforth shall be owner of the copyright of this Work and that any reproduction or use in any form or by any means whatsoever is prohibited without the written consent of UM having been first had and obtained;
- (6) I am fully aware that if in the course of making this work I have infringed any copyright whether intentionally or otherwise, I may be subject to legal action or any other action as may be determined by UM.

Candidate’s Signature :.....

Date:

Subscribed and solemnly declared before,

Witness’s Signature:

Date:.....

Name: **Assoc. Prof. Dr. Mohana Kumari Nambiar**

Designation: **Supervisor**

ABSTRACT

This study examines the teaching of science through English by primary teachers with limited English proficiency (LEP) following the implementation of a language of instruction policy (i.e. English for Teaching Mathematics and Science- ETeMS) in Malaysia. The study investigates the nature of talk by LEP teachers in the rural classroom and its impact on the teaching of science through English which is a form of content-based instruction (CBI). It also investigates the extent to which teacher knowledge bases influenced the language use of the LEP teachers in their delivery of science through English. The theoretical framework for this study is provided by Turner-Bisset (2001) and a case study approach is employed for data collection. Three LEP teachers in a rural primary setting tasked with teaching science through English provided data for analysis. Findings were culled from transcripts of nine lessons taught, observations, interviews, questionnaires and documents.

The findings show that the teachers did have all the knowledge bases for teaching proposed by Turner-Bisset (2001) although the strengths varied. Proficiency in the medium of instruction emerged as the knowledge base that impacted the most on the successful/meaningful teaching and learning of science through English in the rural classroom. Limited English proficiency drove teachers to use their mother tongue (Malay) liberally; to use fragments or simplified structures of English; to rely on Malay grammar, resulting in inaccuracies in language use; and to resort to meaning-focused lessons which left errors uncorrected. Furthermore, limited proficiency in English prevented teachers from being creative in their language use and limited their questioning techniques which seemed to induce low level thinking on the part of students. The above inadequacies impeded their modelling role and greatly constrained their ability to fully realize the intentions of the new science curriculum. The

pedagogical content knowledge that developed from the amalgamation of the different knowledge bases therefore was weak. The LEP teachers, on the whole, lacked knowledge in integrating content and language learning which is critical for the success of teaching science through English.

It can be concluded that the LEP teachers were not empowered to meet the challenges of teaching science through English because they were not fully prepared for it. Compelling evidence from this study shows that language proficiency is a teacher knowledge base imperative for second language teachers tasked with CBI. Therefore, language proficiency, the researcher proposes, deserves inclusion in Turner-Bisset's (2001) model of teacher knowledge bases. It can also be concluded that in order for teachers to succeed in the CBI classroom, they need to be trained in and be knowledgeable of ways to integrate language and content. Achieving well-prepared teachers for teaching science through English therefore should focus on continuous building of teachers' knowledge in the applications of instructional strategies for integrating content and language.

ABSTRAK

Kajian ini menyelidik pengajaran sains menerusi bahasa Inggeris oleh guru-guru sekolah rendah yang lemah berbahasa Inggeris (LBI) berikutan implementasi polisi bahasa untuk pengajaran (Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris- PPSMI) di Malaysia. Kajian ini menyelidik penggunaan bahasa oleh guru-guru LBI di dalam kelas sekolah rendah di luar bandar dan impaknya ke atas pengajaran sains menerusi bahasa Inggeris yang merupakan satu bentuk pengajaran bahasa yang berasaskan subjek bukan bahasa. Kajian ini juga menyelidik setakat mana asas-asas pengetahuan guru mempengaruhi penggunaan bahasa guru-guru LBI di dalam penyampaian sains menerusi bahasa Inggeris. Kerangka teori untuk kajian ini di sumbang oleh Turner-Bisset (2001) dan kaedah kajian kes digunakan untuk mengutip data. Tiga orang guru LBI dari sekolah rendah luar bandar yang dipertanggungjawabkan melaksanakan polisi PPSMI menyumbangkan data untuk dianalisis. Penemuan-penemuan dipetik dari sembilan transkrip pengajaran, pemerhatian, temubual, soal selidik dan dokumen.

Dapatan kajian ini menunjukkan bahawa para guru memang mempunyai kesemua asas-asas pengetahuan untuk mengajar yang diajukan oleh Turner-Bisset (2001) tetapi dengan kekuatan yang berbeza-beza. Kemahiran bahasa pengantar untuk pengajaran muncul sebagai asas pengetahuan yang mempunyai impak paling terkesan ke atas pengajaran dan pembelajaran sains yang berjaya/bermakna melalui bahasa Inggeris dalam kelas di luar bandar. Kemahiran bahasa Inggeris yang terbatas menggerakkan guru-guru menggunakan bahasa ibunda (bahasa Melayu) mereka dengan bebas; menggunakan serpihan atau struktur ringkas bahasa Inggeris; bergantung kepada nahu bahasa Melayu yang membawa kepada banyak kesilapan bahasa; dan cenderung kepada pengajaran yang berfokuskan makna menyebabkan kesilapan terbiar. Tambahan lagi,

kemahiran bahasa Inggeris yang terbatas menghalang guru-guru daripada menunjukkan daya kreatif dalam penggunaan bahasa mereka dan membataskan teknik-teknik menyoal yang kelihatan seperti mendorong pelajar untuk berfikir pada tahap rendah. Kelemahan-kelemahan di atas membantutkan peranan mereka sebagai model dan amat mengekang keupayaan mereka untuk merealisasikan sepenuhnya matlamat kurikulum baru untuk sains. Natiyahnya, gabungan asas-asas pengetahuan yang berbeza kekuatan tersebut menghasilkan *pedagogical content knowledge* yang lemah. Guru-guru LBI, pada keseluruhannya, kurang pengetahuan untuk mengintegrasikan pembelajaran kandungan subjek sains dan bahasa. Pengetahuan ini adalah kritikal dalam menentukan keberkesanan pengajian sains menerusi bahasa Inggeris.

Maka bolehlah disimpulkan dengan itu bahawa para guru LBI tidak berdaya mengatasi cabaran mengajar sains menerusi bahasa Inggeris kerana mereka tidak bersedia sepenuhnya untuk menghadapinya. Bukti-bukti kukuh daripada kajian ini menunjukkan bahawa kemahiran bahasa adalah asas pengetahuan guru yang amat penting bagi guru-guru bahasa kedua yang dipertanggungjawabkan melaksanakan pengajaran bahasa berdasarkan kandungan subjek bukan bahasa. Dengan itu, pada hemat penyelidik, kemahiran bahasa patut dimasukkan ke dalam model asas-asas pengetahuan guru yang dikemukakan oleh Turner-Bisset (2001). Kesimpulan juga boleh dibuat bahawa untuk guru-guru berjaya dalam pengajaran sains menerusi bahasa Inggeris mereka mesti dilatih dalam dan berpengetahuan tinggi tentang cara-cara mengintegrasikan bahasa dan kandungan subjek yang diajar. Persediaan ke arah mencapai guru-guru yang siap-siaga untuk mengajar sains menerusi bahasa Inggeris dengan itu harus bertumpu kepada pembangunan pengetahuan guru-guru secara berterusan dalam mengaplikasikan strategi-strategi pengajaran untuk mengintegrasikan kandungan subjek bukan bahasa dan bahasa.

ACKNOWLEDGEMENTS

As I come to the end of my PhD, I would like to remember and thank the many people who have been the gentle wind behind my back throughout my arduous change journey as an inexperienced researcher. But first and foremost, I thank Allah for giving me the strength, health and guidance during the progress of this study.

I am eternally grateful to my father and my sister, Kak Mon, for taking care of my mother during those times when I could not be there to lend a helping hand. Without their constant emotional support throughout the years, this thesis would not have been possible.

I thank my supervisor, Associate Professor Dr. Mohana K. Nambiar, for asking me those important questions which helped me achieve clarity and coherence to both the content and form of this thesis.

To my friend, Nesamani, whose encouragement, inspiration and help in verifying my translations I owe special thanks.

I extend my gratitude to Lee Luan who has been patient and generous with her time to help me learn to use the NVivo software.

I gratefully acknowledge the support of the University of Malaya for granting me leave of absence to pursue my PhD and for funding my study. I would also like to thank my colleagues at the English Language Department, Faculty of Languages and Linguistics, for taking over my teaching and administrative load during my leave.

I would also like to thank all the participants of this study who had made my fieldwork possible. I am especially grateful to the principal informants (teachers) for sharing their time and experiences in their classrooms.

Many individuals have encouraged, supported and advised me in various ways to give me the strength to persevere. While I cannot possibly thank everyone by name here, I do at least want to acknowledge the contributions of the following people: Kamal, Sharul, Ngat Har, Suad, Veronica, Leela, Evelyn, Liza, Roslina, Nesamalar, Nasir, Rizal, Professor Asmah, Azrina Wati and Zaulin.

TABLE OF CONTENTS

	Page
ABSTRACT	iii
ABSTRAK	v
ACKNOWLEDGEMENTS	vii
TABLE OF CONTENTS	ix
LIST OF FIGURES	xviii
LIST OF TABLES	xix
LIST OF ABBREVIATIONS	xx
CHAPTER 1: BACKGROUND TO THE STUDY	
1.0 Introduction	1
1.1 Educational System in Malaysia	3
1.1.1 The Razak Report (1956)	3
1.1.2 The Rahman Talib Report (1960)	4
1.2 Public Opinion of Teachers in Malaysia	5
1.3 Route Taken by the ETeMS Reform	6
1.4 How ETeMS was Conceived	7
1.5 Reasons for Introducing ETeMS	8
1.6 Objectives of ETeMS	9
1.7 Preparatory Measures Taken for Stakeholders for Implementing ETeMS	9
1.7.1 How Schools were Prepared	10
1.7.2 How Teachers were Prepared	10
1.7.3 How Headteachers were Prepared	13
1.7.4 How Students were Prepared	13
1.7.5 How the Community was Prepared	14
1.8 Teaching and Learning under ETeMS	15

1.9	ETeMS in Action	16
1.10	Public Opinion about the ETeMS Teacher	18
1.11	Statement of Problem	18
1.12	Research Objectives	21
1.13	Research Questions	21
1.14	Significance of the Study	22
1.15	Conclusion	24
1.16	The Structure of the Thesis	25
1.17	Definition of Terms	25
CHAPTER 2: REVIEW OF LITERATURE		
2.0	Introduction	27
2.1	The Implementation Phase in a Change Process	28
2.1.1	The Characteristics of the Change	29
2.1.2	Local Factors	32
2.1.3	External Factors	38
2.2	Eight Lessons on Change	41
2.3	Teacher Professional Development	41
2.3.1	Professional Development under ETeMS	45
2.4	Teacher Knowledge	47
2.5	Turner-Bisset's Model of Knowledge Bases for Teaching	47
2.5.1	Substantive Knowledge	48
2.5.2	Syntactic Knowledge	49
2.5.3	Beliefs about the Subject	49
2.5.4	Curriculum Knowledge	50
2.5.5	General Pedagogical Knowledge	50
2.5.6	Knowledge/Models of Teaching	51

2.5.7	Knowledge of Learners: Empirical and Cognitive	52
2.5.8	Knowledge of Self	54
2.5.9	Knowledge of Educational Contexts	54
2.5.10	Knowledge of Educational Ends	55
2.5.11	Pedagogical Content Knowledge (PCK)	55
2.6	Proficiency in the Instructional Language	56
2.7	Issues in Integrating Content and Language	58
2.7.1	Conceptualizing CBI	59
2.7.2	When to Introduce CBI	61
2.7.3	The Language of Science	62
2.8	Talk in the Classroom	64
2.8.1	Teacher Talk: CBI in an EFL/ESL Context	65
2.8.2	Communicative Competence	68
2.8.3	Errors in L2 Use	68
2.8.4	Focus on Form in L2 Content Learning	70
2.8.5	Negotiation of Meaning	71
2.8.6	The Influence of L1 on L2 Development	72
2.8.6.1	Code-switching	73
2.8.7	Teacher Questioning	74
2.8.7.1	The Reasons Why Teachers Ask Questions	75
2.8.7.2	Types of Questions	76
2.8.7.3	Characteristics of Good Questioning	78
2.8.8	Characteristics of Effective Teachers	80
2.9	Conclusion	81
CHAPTER 3: METHODOLOGY		
3.0	Introduction	82

3.1	Theoretical Framework Underpinning the Study	82
3.2	Research Questions of the Study Revisited	85
3.3	Rationale for Adopting Case Study Approach	86
3.4	Sampling	87
3.5	Data Collection Instruments	92
3.5.1	Audio Recording of Lessons	93
3.5.2	Observations	93
3.5.3	Teacher Interview	94
3.5.4	Teacher Questionnaire	94
3.5.4.1	Teacher Background	95
3.5.4.2	Teacher Perceptions of ETeMS	96
3.5.4.3	Teaching Science through English	96
3.5.4.4	Language Related Issues	97
3.5.4.5	Supplementary Materials	98
3.5.4.6	Teacher Related Issues	98
3.5.5	Documents	99
3.6	Data Collection Procedures	99
3.7	Data Analysis Framework	103
3.8	Quantitative Data Analysis of Classroom Discourse	106
3.8.1	Data Analysis of Teachers' Language Choice	107
3.8.2	Data Analysis of L1/L2 Use and Pedagogic Functions	108
3.8.3	Data Analysis of Teachers' Command of L2	108
3.8.4	Data Analysis of Teacher Questioning Techniques	109
3.9	Qualitative Data Analysis Procedures	110
3.9.1	Qualitative Analysis of Teacher Talk	110
3.9.2	Analysis of Teacher Knowledge Bases	110

3.10	Limitations of the Study	112
------	--------------------------	-----

CHAPTER 4: DATA ANALYSIS AND FINDINGS: LEP TEACHER TALK

4.0	Introduction	115
4.1	Data Analysis of Teachers' Language Choices	116
4.2	Findings on Teachers' Language Choices	118
4.3	Summary of Findings on Teachers' Language Choices	129
4.4	Data Analysis of Teachers' L1/L2 Use and Pedagogic Functions	130
4.5	Findings on Pedagogic Functions and L1/L2 Use	139
4.5.1	Top Five Functions in L1 and L2 by Individual Teacher	141
4.6	Summary of Findings on Teachers' L1/L2 Use and Pedagogic Functions	150
4.7	Data Analysis of Teachers' Command of English	151
4.8	Findings on Error Analysis	151
4.8.1	Findings on Factual Errors	152
4.8.2	Findings on Discourse Errors	157
4.8.3	Findings on Word Choice Errors	158
4.8.3.1	Word Choice Errors: Incorrect Choice	159
4.8.3.2	Incorrect Word Choice: Addition	161
4.8.4	Findings on Syntactic Errors	162
4.8.4.1	Errors in Morphology	162
4.8.4.2	Errors in Agreement	164
4.8.4.3	Tense Errors	165
4.8.5	Pronunciation Errors	166
4.8.6	Omission Errors	170
4.9	Summary of Findings on Error Analysis	174
4.10	Quantitative Analysis of Teacher Questions in English	176
4.11	Findings on Quantitative Analysis of Teacher Questions in English	177

4.11.1	Pedagogic Function of Questions in English	177
4.11.2	Opinion/Factual Questions	178
4.11.3	Type of Response Required	180
4.11.4	Characteristics of Student Response	180
4.12	Qualitative Analysis of Thought Questions	182
4.13	Qualitative Analysis of Question Formations	187
4.13.1	Truncated Questions	187
4.13.2	Compound and Elliptical Questions	192
4.13.3	Wh-questions	196
4.14	Summary of Findings on Teacher Questions in English	197
4.15	Ways in Which the Nature of Teacher Talk of LEP Teachers Impact the Teaching of Science through English	199
4.16	Conclusion	204
CHAPTER 5: DATA ANALYSIS AND FINDINGS: TEACHER KNOWLEDGE BASES		
5.0	Introduction	205
5.1	Analysis of Data	206
5.2	Knowledge of Self	206
5.3	Knowledge of Learners: Cognitive	212
5.4	Knowledge of Learners: Empirical	214
5.5	Knowledge of Educational Ends	216
5.6	Knowledge of Educational Contexts	220
5.6.1	Undue Attention to Examinations	220
5.6.2	Heavy Teaching Load	222
5.6.3	Non-academic Duties	223
5.6.3.1	Undue Importance Placed on School Appearance	224
5.6.3.2	Participation in Competitions	224

5.6.3.3 Clerical Work	225
5.6.4 Teaching in a Rural Context	225
5.6.5 Indecisions over ETeMS	226
5.6.6 Lack of Preparation	228
5.6.6.1 Time Tabling	228
5.6.6.2 Lack of Time	228
5.6.6.3 Teachers' Personal Life	229
5.6.7 The School Infra-structure	230
5.7 Beliefs about the Subject	234
5.7.1 Teaching and Learning of Science	234
5.7.2 The Language of Science	238
5.8 Knowledge or Models of Teaching	239
5.9 Curriculum Knowledge	243
5.10 Syntactic Knowledge	245
5.11 General Pedagogical Knowledge	246
5.12 Substantive Subject Knowledge	247
5.13 Pedagogical Content Knowledge about Content-based Instruction	248
5.14 Lack of Collaboration	250
5.15 Conclusion	253
 CHAPTER 6: SUMMARY OF FINDINGS AND CONCLUSIONS	
6.0 Introduction	260
6.1 Summary of Findings	260
6.1.1 Intrinsic Challenges for Teaching Science through English	261
6.1.1.1 Professional Knowledge and Understanding	262
6.1.1.2 Professional Adequacy	263
6.1.1.3 Professional Attitudes and Values	263

6.1.1.4	Teaching Approach	264
6.1.1.5	Ownership	265
6.1.2	Extrinsic Challenges for Teaching Science through English	266
6.1.2.1	Resources	266
6.1.2.2	Time Management	268
6.1.2.3	Practicality of Implementation	268
6.1.2.4	History and Tradition	269
6.1.2.5	Professional Development and Support	270
6.2	Responses to the Research Questions of the Study	271
6.3	Conclusions	282
6.3.1	Conclusion 1: There is a Case for Language Proficiency as a Significant Teacher Knowledge Base for Implementing Science through English	283
6.3.2	Conclusion 2: The Objectives of the Science Curriculum were Superficially Achieved	284
6.3.2.1	Limited Understanding of the Philosophy Underpinning the Science Curriculum	285
6.3.2.2	Inability to Cope with Increase in Workload	286
6.3.2.3	Inadequate Understanding about Inquiry Approaches	287
6.3.3	Conclusion 3: LEP Teachers in the Primary Setting were poor teachers of Content-based Instruction	289
6.4	Recommendations	293
6.4.1	Redressing Teacher Related Shortcomings	294
6.4.1.1	Enhancing Teacher Knowledge	294
6.4.1.2	Enhancing Classroom Delivery	296
6.4.1.3	Providing Assistance to Ensure Better Delivery of Core Business	297
6.4.1.4	Addressing Shortage of Science Teachers	297
6.4.1.5	Enhancing Teacher English Language Proficiency	298

6.4.2	Redressing Curriculum and Assessment Related Shortcomings	298
6.4.2.1	Review of the Science Syllabus	299
6.4.2.2	Review of Assessment	299
6.4.3	Redressing Infrastructure Related shortcomings	300
6.4.3.1	Monitoring Delivery and Maintenance of Supplies	300
6.4.3.2	Setting Up Good Science Labs, Science Resource Rooms and Libraries	301
6.4.4	Raising English Proficiency for Successful Teaching and Learning through ETeMS	302
6.4.4.1	Ensure Optimum Use of English Language Lessons	302
6.4.4.2	Maintain the ETeMS Policy	303
6.4.4.3	Enhancing Language Teacher Base	303
6.5	Suggestions for Further Research	305
6.6	Concluding Remarks	306
	BIBLIOGRAPHY	308
	APPENDICES	
Appendix 1	Consent Letter from the State Education Office	329
Appendix 2	Observation Sheet	331
Appendix 3	Teacher Questionnaire	332
Appendix 4	Consent Form	340
Appendix 5	Transcription Convention	341
Appendix 6	Transcripts of Teacher Interview Extracts in Malay	342
Appendix 7	Pedagogic Functions and Language Codes in Three Lessons by Ruhani	352
Appendix 8	Pedagogic Functions and Language Codes in Three Lessons by Farina	353
Appendix 9	Pedagogic Functions and Language Codes in Three Lessons by Zuleyka	354

LIST OF FIGURES

Figure 1.1:	A posting by a teacher to an online forum	2
Figure 2.1:	Interactive factors affecting implementation	28
Figure 2.3:	A possible model of knowledge bases for expert teaching in an ESL/EFL context	58
Figure 3.1:	Knowledge bases for teaching: The model (Turner-Bisset, 2001)	84
Figure 3.2:	A diagrammatic representation of the methodology employed for the study	112
Figure 6.1:	A modified Turner-Bisset (2001) model: Knowledge bases for Teaching	284

LIST OF TABLES

Table 3.1:	Details of research participants	89
Table 3.2:	Analytical framework for this study	105
Table 4.1:	Summary of teachers' language choices tallied for three lessons in five categories	118
Table 4.2:	Summary of teachers' language choices tallied for three lessons in three categories	118
Table 4.3:	Language choice in five categories in individual lesson by three Teachers	125
Table 4.4:	Top five most occurring functions and their language type in three lessons by three teachers	140
Table 4.5:	Frequency counts of top five functions in L1 and L2 (Ruhani)	142
Table 4.6:	Frequency counts of top five functions in L1 and L2 (Farina)	145
Table 4.7:	Frequency counts of top five functions in L1 and L2 (Zuleyka)	149
Table 4.8:	Summary of errors in three lessons conducted by each teacher	152
Table 4.9:	Word choice errors in three lessons conducted by each teacher (incorrect choice)	159
Table 4.10:	Word choice errors in three lessons conducted by each teacher (incorrect addition)	161
Table 4.11:	Syntactic errors in three lessons conducted by each teacher	162
Table 4.12:	Omission errors in three lessons conducted by each teacher	171
Table 4.13:	Function of questions in L2 and their frequency in three lessons conducted by each teacher	177
Table 4.14:	Distribution of questions seeking opinion versus factual response in three lessons conducted by each teacher	179
Table 4.15:	Response required from students in three lessons conducted by each teacher	180
Table 4.16:	Length of student response in three lessons conducted by each Teacher	180
Table 4.17:	Manner of student response in three lessons conducted by each Teacher	181

LIST OF ABBREVIATIONS

BICS	Basic interpersonal communicative skills
BM	Bahasa Melayu
CALP	Cognitive/academic language proficiency
CBI	Content-based instruction
CD	Compact disc
CLIL	Content and language integrated learning
DEO	District Education Office
ELTC	English Language Teaching Centre
ETeMS	English for Teaching Mathematics and Science
FELDA	Federal Land and Development Agency
GPK	General pedagogical knowledge
ICT	Information and Communication Technology
IRF	Initiate respond feedback
L1	The first language
L2	The second language
LCD	Liquid crystal display
LEP	Limited English proficient or limited English proficiency
LIP	Language Immersion Programme
MOE	Ministry of Education
MUET	Malaysian University Entrance Test
NUTP	National Union of Teaching Profession
OFSTED	Office for Standards in Education
PCK	Pedagogical content knowledge
PIERS	Project to Improve English in Rural Schools
PPSMI	The Malay acronym for ETeMS

SED	State Education Department
SPM	The Malay acronym for Malaysian Certificate of Education (MCE)
UMNO	United Malays National Organization
UPSR	The Malay acronym for Primary School Assessment Test
KBSR	The Malay acronym for New Primary School Curriculum (NPSC)
KBSM	The Malay acronym for New Secondary School Curriculum (NSSC)

CHAPTER 1

BACKGROUND TO THE STUDY

1.0 Introduction

When the idea of teaching Mathematics and Science in English (ETeMS) in Malaysia was first mooted and bandied around, considering that for almost 40 years it had been done in the national language Bahasa Malaysia, unknown to the researcher her research issue had taken seed. I understood what a daunting task it would be for the teachers, the pivotal stakeholder in the change agenda, to realize this change in the classroom. It troubled me. Teaching mathematics and science through English is really a Malaysian version of content-based instruction which has a dual focus on content and language. How will they cope? Are they ready for this? Can they be good change agents?

I could empathize with them using my own personal experience as a yardstick. I was assigned to teach a linguistic course in Malay early in my career at a local university. I remembered how I laboured every single day throughout the semester to learn up linguistic terminologies and prepare my scripts for instruction. Although I speak proficient Malay, my mother tongue, I was not equipped to teach linguistics in the language. The training I received was in English. I survived the semester making my English-Malay linguistic terminology guidebook a constant companion. Often times my lessons were delivered using a hybrid mix of Malay and English. My students were my lifelines for times when I could not find the words to express my thoughts. The change I endured was very taxing. I was mentally exhausted long before the semester ended.

It was in 2003 that the government made it official. News bulletins and later rumblings from different stakeholders in the education system kept my interest alive. In 2007 I chanced upon this posting to an online forum.

Hello.

I am Science teacher. I teaching in SMK Bingkor in Sabah, Malaysia. Government Malaysia make compulsory in schools for Science subject to be teach using english language, starting in 2003.

I am worry because my english not good. I'm scared one day my students will think i am stupid. I must learning english very fastly.

How can I learn english. please advice me. Thank you.

<http://www.antimoon.com/forum/t5895-0.htm>

Figure 1.1: A Posting by a Teacher to an Online Forum

This teacher, probably an indigenous East Malaysian, like her counterparts the Malays, Chinese, and Indians in West Malaysia, is a product of the education system in which Malay, the national language of Malaysia, is the medium of instruction. This is the root of the problem for many ETeMS teachers. They are expected to use English as their language of instruction. Proficiency in the English language is critical for successful/meaningful teaching under the ETeMS policy but many teachers lack this crucial knowledge base. These teachers do not have the requisite mastery of English. It is the intent of this study to investigate the teacher talk of limited English proficient (LEP) teachers teaching science through English and examine the role of language proficiency as a significant teacher knowledge base in the teaching of science in realizing ETeMS. In this study a prepared teacher is broadly defined as a teacher who possesses the requisite knowledge bases for expert teaching as proposed by Turner-Bisset (2001) and one who is supported by other stakeholders within the educational system (Fullan, 1993a, 2001b). An LEP teacher, on the other hand, is defined as one whose self-assess ability to speak English is less than very good and whose score in the compulsory English Proficiency Test for ETeMS teachers is below Band 3.

A brief history of the education system at this point will, it is hoped, provide a more insightful picture of the typical Malaysian educated through this system.

1.1 Educational System in Malaysia

The early education system in Malaysia (then Malaya) was closely related to Islam but the education landscape changed after the arrival of the British rulers in the late 1800s (Denny, 2001). There were different education systems for the different ethnic groups in the country which were primarily based on what the British rulers decided was appropriate. The education system during that period (pre-1957) “was divided into four streams: vernacular Malay schools, mostly primary schools serving rural Malay children; Chinese and Tamil vernacular schools which were established by the Chinese and Indian communities; English schools maintained by the British government; and missionary schools which served the mixed urban population” (Lee, 2006, p.150). At the tertiary level, all subjects were taught in English (Denny, 2001).

Independence saw a fragmented educational system. The divide and rule strategy employed by the British colonizers contributed to this. Malaysia was determined to change this. Various initiatives were taken and reports containing recommendations for change to the education system were produced. Notable among them are the Razak Report (1956) and the Rahman Talib Report (1960).

1.1.1 The Razak Report (1956)

The Razak Report (1956) recommended the formation of schools with a Malayan outlook using Bahasa Melayu (Malay language) as the national language. It also recommended that the national and English language be made compulsory for all primary and secondary schools. An important recommendation in the report was to adopt a common syllabus for all schools in Malaya as it was deemed necessary to

promote national unity in the new nation through education. Through the use of a common language and a common curriculum, a national education system was established. It was hoped that the change would bring about social cohesion and a new national identity. The MOE was established to play a central role in controlling the curriculum and the examination system and to reorganize the school system (Lee, 2006).

1.1.2 The Rahman Talib Report (1960)

The Rahman Talib Report (1960) in aiming to strengthen the national language and to provide more education opportunities recommended free primary education to be made available for all children. In order to promote unity among the different ethnic groups the report recommended all government-assisted primary schools were to be changed to national and national-type schools and a common official language for all public examinations in secondary schools was decided (Ministry of Education, 2001).

These recommendations formed the basis of the Education Act of 1961 which became the foundation of the National Education Philosophy:

Education in Malaysia is an on-going effort towards further developing the potential of individuals in a holistic and integrated manner, so as to produce individuals, who are intellectually, spiritually, emotionally and physically balanced and harmonious, based on a firm belief in and devotion to God. Such an effort is designed to produce Malaysian citizens who are knowledgeable and competent, who possess high moral standards, and who are well responsible and capable of achieving high level of personal well-being as well as being able to contribute to the harmony, and betterment of the family, the society and the nation at large (Ministry of Education, 2002, p. vii).

The Education Act (1961), its aim being the achievement of national unity and development through education was phased in beginning 1969. Slowly, the education system developed a Malaysian outlook and became more Malaysian in its curriculum (Rahimah, 1994). As Malaysia distanced itself from the English medium of education, the level of English proficiency among Malaysians gradually declined. Given this

profile of the majority of the teachers currently serving Malaysian schools, one can better understand why letters to the newspapers abound with barbed comments about ETeMS teachers and their lackluster performance in the classrooms (see Sections 1.2 and 1.10 below).

1.2 Public Opinion of Teachers in Malaysia

Reading the comments about teachers in Malaysia in the local dailies, it also became clear to me that the general opinion about teachers in the present system is, in the main, uncomplimentary. One reader in a local daily wrote this piercing criticism about our ETeMS teachers:

I think the basic problem lies with the teachers. There is no sincere effort among them to master the language themselves in order to be able to teach with confidence (Chella, 2009, p. N29).

Sharing the same sentiments another reader wrote this:

If we look at our current system, I fear we are not getting the right people to become teachers. Our training system doesn't seem to equip our teachers with the right attitude to teach and it had not provided the best for our students. We need to employ the best people to the job of nurturing the young minds. These people should have the correct mindset as educators. However, to most of our teachers today, teaching is just another routine job like any other profession (Nathesan, 2010, p. 44).

A columnist for Harakah, the organ of the opposition political party Parti Islam SeMalaysia (PAS), added:

...educator attitudes have also changed with time. Teachers are not as passionate about teaching and children as they once were. They are less motivated to see students excel...(Maria, 2008, p. N21).

Given the lack of faith in the teachers by the public and the call for help from the teacher (see Section 1.0) gave me the impetus to discover for myself how LEP teachers deliver science through English (or better known in Malaysia by its Malay acronym PPSMI). At this juncture the route taken by the ETeMS policy would put things in better perspective.

1.3 Route Taken by the ETeMS Reform

With industrialization and the coming of the ICT Age, the promise of a developed nation status meant that Malaysians had to be both proficient in English and competent in ICT skills. The then Prime Minister of Malaysia, Dr. Mahathir Mohamad, had a change agenda for the nation.

Everyone should be open to change. And it is firmly believed that to effect meaningful change the following imperatives must be ensured: realistic, translatable goals, careful planning of the route to be taken to realize the goals, the state of readiness of all stakeholders in the reform agenda and once implemented a monitoring mechanism is in place. In order to better understand the reality of the ETeMS teacher a more in-depth picture of ETeMS is needed.

Change is a theme that is synonymous with the education system in Malaysia. The MOE as a main stakeholder in the education system had outlined its mission for the realization of Vision 2020 (A development plan aimed at developing Malaysia into a fully developed and industrialized nation by the year 2020) as “To develop an education system that is of world standard in order to fully develop the individuals potential and able to fulfill Malaysia’s aspirations...for this purpose, other aspects are also given attention- curriculum, quality teachers, present infrastructure and an efficient management system” (Ministry of Education, 2001, p. 16). The education system has seen policy changes in the curriculum. The major change relevant to this study was the introduction of KBSR (New Primary School Curriculum, NPSC) and KBSM (New Secondary School Curriculum, NSSC). Since the present study investigates the primary school, only NPSC will be described in detail here.

The aim of the NPSC is not only to produce students who are intellectual, but also of high moral standards.

The NPSC curriculum is organized into three parts: communication, human and environment, and individual development. Each part is divided into four components which include basic skills, spirituality, values and attitude; humanity and environment and arts and recreation. In 1993 the name New Primary School Curriculum was changed to Integrated Primary School Curriculum (IPSC) in line with the focus given to the concept of integration.

Through IPSC, changes were made in several subjects including language, physical education, Islamic education, and moral education. New elements such as patriotism, integration, school culture, creative and critical thinking skills, generic skills, contextual learning, mastery learning, self-access learning, scientific skills, and multiple intelligence were included (Ministry of Education, 2001, p. 21).

One of the most recent medium of instruction related policy changes is the much debated ETeMS.

1.4 How ETeMS was Conceived

Malaysia comprises three main ethnic groups, the Malays (about 60%), the Chinese (about 25%), and the Indians (about 7%) (Azirah, 2009) with the remainder consisting of over twenty ethnic indigenous peoples (Denny, 2001). In 2001, Mahathir as the President of the United Malays National Organization (UMNO) which is the biggest component of the ruling party Barisan Nasional representing the Malay ethnic group addressed the UMNO general assembly. He reminded the Malays that their being deficient in ICT skills and their poor mastery of English had prevented them from mastering knowledge which was the catalyst for the industrialization process. Mahathir asserted that if the Malays did not want to miss out on the developments in Information Technology, they had to seriously learn and be committed to learning this new knowledge. And one of the pre-requisites for mastering this knowledge is the mastery of the English language. This set the ball rolling for the policy of ETeMS.

On 6 May 2002, Mahathir stated that the government was willing to reintroduce the English-medium schools to arrest the decline of the standard of English if the people wanted this. The supreme council of UMNO objected to the proposition as it ran contrary to the National Education Policy which promotes the use of the national

language as the medium of instruction. UMNO backed instead the proposal to use English for the teaching of mathematics and science in schools (Netto, 2002). On 10 May 2002, Mahathir announced that instead of reintroducing the English medium school system, the government intended science and mathematics to be taught in English starting with Year 1 in primary schools and Form 1 and Lower 6 in secondary schools beginning 2003 (Ministry of Education, 2004).

In Malaysia, language planning and educational policies have always been the domain of the central government but as Pillai (2002a), a social commentator, pointed out, the people like to be consulted. His disapproval of the manner in which the government made its drastic decision about ETeMS is evident from his remarks:

It decided, without debate and argument in Parliament and outside, to bring English back into the curriculum; modified it when the UMNO supreme council wanted it restricted to science and mathematics, decided, for no rhyme or reason, to begin from January 2003. Undecided is where the teachers would come from, how learning English in science and mathematics would make one proficient in it. If I were to learn science and mathematics in Swedish or Swahili, would I, at the end of the day, be proficient in either? (Pillai, 2002b, p. 1)

1.5 Reasons for Introducing ETeMS

In 2003, despite objections from various quarters (Johnson, 2002) ETeMS was introduced to Year 1 and Form 1 pupils. ETeMS was introduced out of concern over the deteriorating command of English among young Malaysians who were finding difficulties in getting employment partly due to their lack of English proficiency. Prescribing English for mathematics and science also came about from the realization that English is important as an international language for trade and the transfer of scientific knowledge and technology in preparing Malaysia to achieve its Vision 2020 (Gill, 2004). It was argued that the Malay language failed to convey meaning precisely in translations from English texts, if they were translated at all. The Malaysian government also realized that its national language and translation bodies were unable

to keep pace with the translation of technical literature into Malay. On these grounds Malaysia faced the possibility of falling behind in its race for developed nation status and in the competition for foreign investment (Johnson, 2002).

1.6 Objectives of ETeMS

Given the compelling reasons for having an ETeMS reform, the government had the following objectives in its science curriculum:

- To provide opportunities for students to acquire science knowledge and skills, develop thinking skills and strategies, and thoughtful learning through the inquiry approach
- To produce active learners by providing ample opportunities to engage in scientific investigations through hands-on activities and experimentations
- To keep abreast of developments in science and technology by enhancing their capability and know-how to tap the diverse sources of information on science written in English
- To provide opportunities for students to use English and hence increase their proficiency
- To develop students' ability to use English for study and communication

(Ministry of Education, 2002, p. xi)

The literature on ETeMS has also cited the following as the goals of ETeMS. Improving English standards, which had declined, was the overriding goal of ETeMS (MacKinnon, 2008). The decision to re-adopt English as the medium of instruction for mathematics and science was to ensure that Malaysia remains an economic 'powerhouse' with qualified human resources, who are able to participate competitively in the global market (Noraini et al.; 2009). ETeMS was premised on the argument that mastery of the English language would enable students to access the internet, read articles and research papers, and other materials published in English.

1.7 Preparatory Measures taken for Stakeholders for Implementing ETeMS

The Malaysian government had to show its commitment to the ETeMS change project. As ETeMS was an ambitious, large-scale change initiative, the cost of its

implementation was naturally high. The Budget for the year 2003 indicated close to RM5 billion (approximately EUR1.05 billion) was allotted to the Ministry of Education (MOE) to facilitate the implementation of ETeMS (Sophia et al., 2009).

1.7.1 How Schools were Prepared

In order to enhance the educational infrastructures at the schools, in particular the use of ICT in teaching and learning, 47,000 laptops worth RM235 million were distributed in 2003 alone (Pupur, 2006). Paraphernalia such as LCDs, screens, trolleys, and printers were also supplied to schools and teacher training colleges (Alis, 2006). In small schools and those without electricity, generator sets and a 34-inch digital television set were given in place of LCD projectors (“Teaching Maths and Science,” 2002). To assist information retrieval and communication, schools were provided with internet connection.

1.7.2 How Teachers were Prepared

All ETeMS teachers were paid a special monthly allowance to encourage them to buy books or attend English tuition classes. In addition, the MOE conducted tests twice a year to establish teachers’ proficiency to ensure that students were well taught (Kong, 2008). Teachers who failed to perform were required to attend courses in English. To equip future teachers, adjustments were made to programs at the tertiary level. In addition to these initiatives by the MOE, assistance was also provided by non-government agencies. The royalty of the state of Negeri Sembilan for example, collaborated with HSBC Bank Malaysia to sponsor the Project to Improve English in Rural Schools (PIERS) which involved teachers from several schools within the state (Hariati, 2007).

The Malaysian education system which had disregarded English language for decades had fallen into a state where English proficient teachers were rare. Pillay (1998, p. 3) reported:

There is a growing concern about English teachers' proficiency and competency. Firstly, we are now recruiting teacher trainees who have had their school education in Bahasa Malaysia and have studied English as a subject in the curriculum. Secondly, since Malaysia wishes to provide every student with access to English education, large numbers of teachers have to be trained. Many of these trainees may not have achieved a high level of competence in English. Thirdly, 1990 to the middle of 1997 were economic boom years. The teaching profession had to compete with other professions to attract competent young people. The higher pay and other perks offered by the commercial sector has meant that the teaching profession has been able to attract fewer people with a high level of competence in English to train as teachers. The public, especially parents, has often raised this issue in the press.

The Teacher Education Division of the MOE developed a training programme called English for the Teaching of Mathematics and Science (ETeMS) to help teachers adjust to the change in the medium of instruction policy. The first cohort of teachers, 33,387 in total, was required to undergo ETeMS training in 2002 (Pupur, 2006). Other teachers were trained in stages and by 2004 more than 50,000 teachers had gone through the mandatory nationwide induction programme.

The ETeMS programme involved 240 hours and was conducted in two phases. Each phase comprised 90 hours of face-to-face interaction and 30 hours of self-instructional materials which included weekend training (2 days of face-to-face interaction over a period of 5 weeks, totaling 60 contact hours per phase) and full immersion (a 5-day module totaling 30 hours per phase) (Chan et al., n.d.). Post-training monitoring was done for teaching, however; this important aspect was excluded for the self-instructional component.

A team of two English language teachers facilitated training. All training modules were prepared "based on a needs analysis conducted in a sample of semi-urban and urban primary and secondary schools" (Choong, 2003, p. 4). The ETeMS training in its aim to

raise the language proficiency of mathematics and science teachers focused on three broad areas:

- A. Language for Accessing Information
This component aims to enhance the information getting skills, especially through reading. Teachers will develop these skills by engaging in a variety of mathematics and science texts. These texts used will include content area topics, curricular materials such as syllabuses, handbooks etc. and texts dealing with methodological issues. It must be emphasized that the focus of instruction is to develop the language skills needed for accessing information in texts, and not to provide instruction in the content or methodology of the subject. It is hoped that as they develop these skills the teachers will be motivated to access on-line and print material to extend their knowledge of current content and pedagogy, and therefore, positively impact the delivery of their subjects in the classroom.
- B. Language for Teaching Mathematics and Science
In this component the teacher will develop language for use while teaching in the classroom as well as the language needed for out of class activities related to the subject. The focus of instruction here would primarily involve speaking and writing skills, and will be supported with adequate grammar input and practice. This is a major component of the ETeMS programme.
- C. Language for Professional Exchange
As professionals the MST (mathematics and science teachers) would conceivably wish to communicate with peers in the wider discourse community through English. A small component of the ETeMS programme will take into consideration this need of the teachers.

(Chan, et al., n.d., General Information, gloss added)

These areas were emphasized as the ETeMS training was premised on the assumptions that participating teachers “already possess the content area knowledge and the pedagogical skills relevant to their subject”, and that they have, “at the very least a basic level of English language proficiency acquired through instruction received in their primary and secondary schooling” (Chan et al., n.d., General Information). Perhaps, the urgency of policy implementation and the sheer numbers of teachers to be trained forced its designers to make these assumptions. In attempting to provide reference points for meaning and pronunciation, the MOE supplied teachers with dictionaries with CD-ROMs and grammar books. In addition, teaching courseware and learning courseware were provided to assist instruction. To encourage professional development and sustain implementation, a mentor-buddy system was introduced. Proficient senior mathematics and science teachers were trained to help their less proficient science and

mathematics buddies in the same school (Choong, 2003; Ministry of Education, 2004). According to Calderón et al. (2011), schools that serve English learners must have a strong focus on professional development and this must be intensive and ongoing, with many opportunities for both peer and expert coaching and information exchange among implementers.

Teaching is a complex process and expert teaching involves the interactions of many constituents of teacher knowledge which include among others subject content knowledge, student factors, teacher factors, curriculum knowledge, and pedagogical knowledge (Berliner, 1987; Shulman, 2004; Turner-Bisset, 2001). The training strategy adopted by the MOE which only addressed certain teacher knowledge bases is likely to impact on teachers' preparedness for the job in important ways.

1.7.3 How Headteachers were Prepared

Although various measures were put in place to ensure teacher preparedness for teaching science through English, less was done to prepare school heads. Their role appeared to be limited to monitoring and reporting the change process. Perhaps, limited preparation of school heads explains the lack of cooperation given by some of them. It was reported that there were headteachers who were reluctant to “allow teachers to leave for training or to train other teachers for fear of a decline in student performance in the two subjects” (Choong, 2003, p. 3).

1.7.4 How Students were Prepared

The literature on CBI has shown that developing academic language skills is not achievable within a short time. Studies of immersion programmes within the L2 community reported that a period of five to seven years is required to develop academic language skills (Baker, 2001; Collier, 1989; Cummins & Man, 2007). This means that

within the estimated period, students were not only taught in the L2 but also had plenty of exposure to it outside of school.

The estimated time between five to seven years to develop academic language skills implies that only at secondary level will students be ready to have English as a medium of instruction. However, neither the students nor Malaysia can afford the time to wait that long. This could be the reason that drove the MOE to implement ETeMS from as early as Year 1 of primary school. Grabe and Stoller (1997) pointed out that it is impractical to postpone content instruction to allow time for students to develop academic language as students have complex educational needs. Learning content information must occur while they are acquiring academic language. With CBI, students are actively developing their proficiency in English while studying subject matter other than English.

Just like training was staggered for teachers, a staggered implementation strategy was used to phase in ETeMS. Only Primary 1 students and Form 1 and Lower 6 students were involved when ETeMS was first implemented in 2003. As a sizeable portion of these students were not proficient in English, learning materials incorporated a glossary of English words in Malay. To help these students cope better during examinations, bilingual (Malay and English) assessments were introduced. Extra classes were arranged by schools to extend further assistance to students in the two subjects. Non-government agencies supported students by providing funds to schools to finance remedial classes.

1.7.5 How the Community was Prepared

As ETeMS was implemented drastically the community at large was rather concerned despite acknowledging the importance of English. The MOE in its effort to allay some

of the fears expressed by parents and the wider public continued to explain the policy and its commitment to the change project through talks and the media.

1.8 Teaching and Learning under ETeMS

The stated objectives in the science curriculum for primary school (see Section 1.6) imply that under ETeMS, teachers can no longer play the role of providers or transmitters of knowledge nor can students be passive recipients of knowledge. The objectives also suggest that teachers for teaching science through English (ETS) need to be equipped with a strong foundation of the language in order to increase the potential of the science classes as an avenue to develop students' L2. This makes good sense but getting it done appears to be a tall order. According to Yerrick, (1998) “the practice of teaching science looks quite different if its goal is for students to acquire a new discourse” (p. 263). He points out that teachers “must serve to facilitate student talk around meaningful artifacts and be ready to re-frame and re-voice student contributions overtly when it is maligned with the values of the new discourse” (p. 263). The notion of teachers as facilitators or guides, I believe, is foreign to most teachers as teaching and learning have been for the most part teacher-centred. In suggesting that there are flaws and weaknesses in the teaching and learning of science and mathematics in schools, Jamaludin (n.d.) stated that “At present, there are evidence that teachers and students alike are so into traditional teaching...where students are passive learners, *listening* to teachers and taking the role of stenographers, while teachers are expected to “*talk*” to the students proficiently in English” (p. 11, emphasis in original). In a letter to the Editor, a reader opined that our students are too dependent upon teachers (Nathesan, 2010). With regard to proficiency in the language of instruction, it is an open secret that teachers need help to improve their English (Liong, 2010). It begs the question of how LEP teachers can implement ETeMS.

1.9 ETeMS in Action

When the government decided to choose mathematics and science as the content subjects to be taught in English, discussions through print and online media revealed that there were objections to the choice. Professor Emeritus Asmah Omar (personal communication, 8 September, 2008), one of Malaysia's renowned sociolinguists and an agent in the conception of ETeMs, however, believed that the decision must be supported. She argued that it is relatively easier to master the English language of science and mathematics at the primary level as both the subjects use more non-linear texts than linear texts in contrast to other content subjects. Non-linear texts, according to Asmah, transcend language barriers, and any individual who looks at one finds it relatively easy to decode information regardless of his or her language background. Additionally, the linear texts of mathematics and science are quite simple; its linguistic structures are not complex and the same structures are repeatedly used. Asmah expounded that if English is taught through a subject like history for example, the level of difficulty would be greater. This is because such a subject is textually heavy. The linguistic structures that need to be mastered too would be greater and more complex. To the Malay nationalists who often cited grave concern over Malay language losing its currency (Nik Safiah, 2009; Zainal Abidin, 1998), Asmah assured that Malay will remain strong if textually heavy content subjects continue to be taught in the language.

If in the case of choice of subjects objections came almost immediately, in the early stages of the implementation of ETeMS, there were glowing reports in the print and electronic media giving the impression everything was well. For instance, on 14 January 2004, the New Straits Times with the headline *Teachers, students adapting well to English switch* reported that "on the whole teachers and students are coping with the

change". Another headline from the same newspaper on 23 December 2005 stated *High pass rates in science, maths*. The MOE reported that:

Initial feedback in terms of policy outcomes has been positive. Parents and the wider public resistance towards the switch in medium of instruction for the two subjects is subdued by the growing competencies of teachers to teach mathematics and science in English. The continuous monitoring and support given by the government and non-government agencies in the implementation of the program also reduced parents' resistance towards the policy (Ministry of Education, 2004, pp. 10-11).

The secretary-general of the National Union of Teaching Profession (NUTP) stated that while many teachers still had difficulties teaching the two subjects in English, they had adjusted and accepted it as part of their job (Chok, 2007).

Despite the attempts to convince the masses that the policy was making headway, the reality was disappointing. Vincent Chew, a participant at a roundtable discussion organized by the MOE, pointed out the inability of some teachers to use English correctly to teach concepts. Another speaker at the discussion stated that many teachers were anticipating a return to the use of Bahasa Malaysia for teaching the two subjects and so lacked the desire to master English (Chew, 2008). It was reported that some teachers continued teaching mathematics and science in Malay although their students had learned both subjects in English previously (Chooi, 2009). According to Chooi (2009), a teacher survey by NUTP repeatedly showed that teachers, in general, were unable to cope with the language. Some teachers in the survey admitted that they had nowhere to go for help with pronunciation and other matters. Some confessed they still lack confidence and struggled daily to teach the two subjects in English.

The dissenting voices grew louder as politicians, NGOs, academicians and others united to demand for the reversal of ETeMS. The findings of a large scale study conducted by researchers from Universiti Pendidikan Sultan Idris (Isahak et al., 2008) added fuel to the opposition against the policy. The principal researcher reported that the policy was a failure. He further claimed that it impacted especially the Malay students in national

schools and the most disadvantaged were the rural poor. The study therefore recommended that the subjects were to be taught in Malay. Another reason cited for wanting to dismantle the policy was that teachers were not doing what they were supposed to do to achieve the expected results envisaged by the policy makers.

1.10 Public Opinion about the ETeMS Teacher

In discourse on ETeMS, teachers were castigated by all and sundry. Our education system, it was said, has attracted the wrong kind of candidates for the teaching profession (Nathesan, 2010). Teachers were perceived as being dispassionate and incompetent (Maria, 2008; Vasanthi, 2004). One correspondent had simply written them off as a lazy lot (“Let’s Be More Realistic,” 2009). This letter published in the 7 June 2007 edition of The Star newspaper gave evidence of science teachers’ difficulty functioning in English:

“What to keep the change”, “What to keep the measure” and “What to keep the same”. These were questions that appeared in a student’s Year 4 mid-year science paper recently. The peculiar way of referring to Manipulated Variable, Responding Variable and Constant Variable (or what might appear to be an effort at simplifying these scientific terms) did not only occur throughout Section B of the exam paper; it was also used while teaching in class and in printed notes given out prior to the exam. The fact that the paper was set by the Head of the Science panel and approved by the Guru Penyalia Kanan 1 (Senior Assistant Teacher) makes this mistake appalling. Clearly, a lot of confusion can be caused during the foundation years, to the detriment of the students, if such manner of teaching science is allowed to perpetuate. Small wonder why there is increasing concern about the teaching of math and science in English.

– Concerned Observer, Selangor (p. T8).

An extract of the examination paper was also printed next to the letter.

1.11 Statement of Problem

The Ministry reported that the initial response to ETeMS was encouraging. However, there were indications that all was not well with the change initiative. This was evident in a study by Sophia et al. (2010). The study examined questions asked by nine Year 4 teachers which revealed that student participation in the classroom was not very

encouraging as there was little meaningful and extended communication between teachers and their students. A high percentage of student response to teacher-initiated questions appeared to be single words. The researchers concluded that there was a pressing need for teachers to develop and implement a more efficient strategy centred on meaningful construction of science concepts. They also recommended addressing the challenges of the teaching of science through a second language.

In another study related to ETeMs, Tan (2011) explored secondary mathematics and science teachers' beliefs about language in content learning and how these impacted teachers' instructional practices and their students' learning. The study which included four science, three mathematics teachers and one English teacher revealed that teachers' beliefs about their respective roles as only content or language teachers limit students' language learning opportunities. The study also revealed that collaboration between content and language teachers was also lacking. Tan perceived a need for sustained professional development for both groups of teachers particularly with regard to content and language integration.

Ong and Tan (2008) explored ETeMS teachers' experiences and classroom practices. The participants were two mathematics teachers and two science teachers from an urban and a rural school. Their observations and teacher interviews showed that while teachers were supportive of ETeMS, teachers particularly those who were educated in the Malay medium, still struggled to convey concepts and ideas to their students verbally.

In a survey of recent work on content and language integrated learning (CLIL), a term frequently used in European countries to refer to CBI, Dalton-Puffer (2011) reported that there is a tendency for increased teacher-centred instruction in CLIL classrooms because "teachers' limited L2 competence may prompt them to adhere very closely to their preparation" (p.190). In an African-based study, Kyeyune (2003) observed that

CBI teachers who lacked awareness of their own inadequacy in language use were inclined to assign blame to students for any gaps in learning. This caused students to feel tremendous stress. Another finding of concern that has emerged from studies on CBI classrooms is the transference of teachers' language errors to their students (Nell & Müller, 2010). Although these findings were made in CBI contexts outside of Malaysia, they are mentioned here for the serious implications they have for the local context with regards to teachers' language proficiency for successful and meaningful teaching of science through English.

The teacher whose cry for help was highlighted in the introduction to this chapter is illustrative of crisis associated with ETeMS. The following comment by another teacher who considered herself ill-prepared for ETeMS is further evidence that ETeMS is problematic and not so straightforward:

...when I became a teacher, a Chemistry teacher, teaching in BM was easy. But in English? It was a disaster at first. I could not understand my own explanation!...I paused more than I talked. In my head I actually constructed the sentences in BM, then translated it into English and said it out loud. It really sounded awful (Liong, 2011, p. N44).

The teachers seem to be in despair and it appears that they need to resort to hit and miss techniques as coping strategies. Why then is the teacher in the present system in this plight? How much poorer, than what is reflected in the letters, can the level of proficiency of the teacher in the rural schools be then? Surely this puts teaching and learning at risk? Was the teacher's readiness already suspect even before she even embarked on her challenging journey? Why did the crucial support, that was supposedly already in place, not help ease the growing pains that comes with change? Did she have all the knowledge bases that make her an effective teacher? These were pressing questions that needed urgent answers. As the teacher is the cornerstone in the teaching of science through English in the classroom, teacher preparedness is the key for delivering meaningful instruction. With these issues in mind, this study will therefore

investigate the role of language proficiency as a crucial knowledge base for the teaching of science through English. The investigation will be based on the theory that teaching is a knowledge-based activity and that teachers need many different kinds of knowledge bases to effect meaningful instruction in the classroom (Parker, 2004; Shulman, 2004; Turner-Bisset, 2001).

The following section deals with research objectives, and research questions derived from what the study aims to investigate.

1.12 Research Objectives

The general objective of this study is to examine the role of language proficiency as a significant teacher knowledge base in the teaching of science through English. More precisely, it aims:

1. to investigate the role(s) of language proficiency as a crucial teacher knowledge base when a subject (science) is taught through a second language (English) by the teacher with limited English proficiency (LEP).
2. to discern the knowledge bases that need strengthening in the teacher with limited English proficiency (LEP) for meaningful teaching of science through English to occur in the primary classroom.
3. to examine how teacher talk of teachers with limited English proficiency (LEP) impacts the teaching of science through English in primary classrooms.

These objectives are addressed through the following research questions:

1.13 Research Questions

Research Question 1

How does the nature of teacher talk of LEP teachers impact the teaching of science through English in primary classrooms?

- (a) What is the impact of language choice on the teaching of science through English in primary classrooms?

- (b) Do language choice preferences in realizing pedagogic functions affect the teaching of science through English in primary classrooms?
- (c) To what extent does the command of language affect the teaching of science through English in primary classrooms?
- (d) How does the quality of questioning techniques affect the teaching of science through English in primary classrooms?

The first question is answered by examining aspects of teacher talk related to language choices, the functional distribution of English and Malay languages, the accuracy of English language use, and teacher questioning and student response. Language choices are investigated to determine the proportion of English language use in the classroom. Language choices related to particular pedagogic functions are studied to determine the range of functions for which English is used. Accuracy of language use is investigated to uncover the range of errors committed by the teachers. Teacher questioning and student response are given focus to determine the quality of questions asked and the kind of learning promoted by the teachers. This reveals how close the teaching style is to the inquiry approach recommended by the syllabus. In addition, teacher questions reflect teachers' syntactic knowledge of science.

Research Question 2

What teacher knowledge bases did the LEP teachers have/did not have that influenced their English language use in the teaching of science through English?

In order to seek the answer to the second question the study draws on the theory of teacher knowledge for expert teaching by Turner-Bisset (2001) (see Sections 2.5 to 2.5.11) to guide its analysis.

1.14 Significance of the Study

ETeMS has been studied in a myriad of perspectives by various researchers. Among topics researched are: the professional development of teachers (Noraini et al., 2007;

Ong, 2004), the discourses of doing science (Revathi et al., 2006), teachers' reactions to ETeMS (Balkis, 2004; Veloo, 2003), teachers' perceptions of ETeMS (Abu Bakar, 2006), the effects of using English on instruction (Isahak et al., 2008), improving teaching and learning skills (Ng, 2005), the challenges of using scripted lessons (Tay, 2009) and the implementation of ETeMS in secondary schools (Palaniapan, 2007; Rasidi, 2004). Several studies cited above have touched on teacher-related issues, but there is still a need to give attention to teachers and in particular the teaching of science through English by LEP teachers. This study hopes to contribute in a small way to this end.

One of the issues often cited in the discourse about ETeMS and also a main reason for its reversal later was teachers' lack of English language proficiency. Attempts to assess teachers' English language proficiency by the MOE previously relied on the administration of questionnaires and proficiency test which might not yield insights about actual language use. The current study hopes to provide a more accurate picture of the present state of affairs with regard to the use of English, in particular by LEP teachers through careful examination of their teacher talk in the science classrooms. The findings which highlight the weak areas can serve as a base in designing language training programmes for CBI teachers.

More importantly, the significance of this study lies in its empirical analysis of teachers' knowledge bases in order to determine the teacher knowledge needed to teach science through English successfully. Employing the model of teacher knowledge bases by Turner-Bisset (2001) as its analytical tool enables this study to unearth the knowledge bases that are present in the teachers' practice as well as those that are still lacking.

The study which is situated within a particular context of rural Malaysia provides insights into the intricacies and challenges involved in the teaching of science through

English in such a context. The findings made add to our body of knowledge about teachers' profile in rural primary schools. These findings could help in addressing teacher-related issues and finding resolutions for them.

One phenomenon that is characteristic of the world today is multilingualism. More and more countries therefore have to make decisions to resolve the tensions that revolve around the issue of which language will be the language of instruction (Gill, 2002, 2004). In some countries, it will be a decision of choice among the languages used within the country. For countries that are interested in improving their global competitiveness while maintaining their cultural heritage, the decision regarding the language of instruction will involve choice between the national language and an international language like English. Making informed choices about these has implications for where research attention must be directed to. There will be a progressive demand for studies asking the kinds of questions that the current research addresses. This will enable decision-makers to know not only what questions need to be satisfactorily answered but also what the implications of each choice would be. The research questions that this study raises and the findings it will come up with will certainly contribute to this research effort.

1.15 Conclusion

This chapter provides the rationale and background to set the stage for this study. It discusses the significance of examining the language use and knowledge bases of LEP teachers teaching science through English in the primary school. The aspects of LEP teachers' language use and their knowledge bases which are given prominence in this study it is hoped would contribute to the body of knowledge on the role of language proficiency and teacher knowledge in the ESL/EFL content-based classroom.

1.16 The Structure of the Thesis

There are five other chapters to this thesis besides Chapter 1 which has just been described. Chapter 2 shall describe the literature review focusing on themes which are closely related to the study which investigates the teaching of science through English by LEP teachers. Chapter 3 describes the methodology for this study and this is followed by two chapters on data analysis and findings. Chapter 4 covers data analysis and findings related to LEP teacher talk while Chapter 5 concerns data analysis and findings related to teacher knowledge bases. Chapter 6 provides the summary of findings and conclusions based on the findings.

1.17 Definition of Terms

The following lists the definition of terms used in this thesis:

Change agent (teacher)	A teacher as a change agent is one who has been tasked with the implementation of a new policy (ETeMS) and who has the power to effect change.
Content-based instruction	Content-based instruction is an approach in second and foreign language teaching which focuses on the concurrent study of language and subject matter. In this approach the form and sequence of language presentation are dictated by content material.
Content and language integrated learning	This term is used mostly by researchers within Europe to refer to content-based instruction.
Expert/ effective teacher	A teacher whose pedagogical content knowledge comprised of all the knowledge bases contained in Turner-Bisset (2001) Model of teacher knowledge bases. In this study, language proficiency in the medium of instruction is also a component of teacher knowledge necessary for effective/meaningful teaching of science through English.
Foreigner talk	In this study, foreigner talk refers to the type of speech that is characterized by such properties as simple word order, grammatical distortions and more common vocabulary items.

Knowledge base	A knowledge base for teaching refers to a category of teacher knowledge which is deemed necessary for effective/meaningful teaching. Substantive knowledge, curriculum knowledge, knowledge of students, general pedagogical knowledge and pedagogical content knowledge are some examples of knowledge bases required for teaching.
LEP teacher	In this study, an LEP teacher is defined as one whose self-assess ability to speak English is less than very good and whose score in the compulsory English Proficiency Test for ETeMS teachers is below Band 3.
Pedagogical content knowledge	Pedagogical content knowledge is a form of knowledge which enables the teacher to transform personal (hidden) knowledge of a particular subject into a form that is comprehensible to students.
Stakeholders	Stakeholders within the education system include teachers, schools, headteachers, students and the community. They all have a role to play in determining the success or failure of a change initiative. In this study, stakeholders are also referred to as change agents.
Teacher talk	The language used by a teacher to get things done in the classroom.

CHAPTER 2

REVIEW OF LITERATURE

2.0 Introduction

This study examines the teaching of science through English in realizing ETeMS by LEP teachers in a rural primary school. It is in essence an investigation about teachers dealing with change which has been initiated by others. In order to analyze and discuss teachers' instructional practices within the context of change, it is imperative for the researcher to possess a thorough understanding of what this entails. This chapter therefore begins with a review of literature on the implementation phase in a change process. Implementing change requires using new materials, engaging in new behaviours and practices, and incorporating new beliefs (Fullan, 2001a). Professional development, which will be the next theme of this review, is one way to develop these. Before a teacher can successfully engage in change in the classroom, she must first be an effective teacher. An effective teacher must have certain competencies in her repertoire. These involve knowledge bases. Thus, the review of literature related to teacher knowledge bases will take centre stage following the discussion on professional development. The next section will deal with CBI as science through English is a form of CBI, that is, an instructional approach which involves the dual development of language and content. The final section focuses on teacher talk since it is the quality of this talk that determines the quality of learning. Professional development, teacher knowledge, CBI and teacher talk all relate closely to the theoretical framework that grounds this study.

2.1 The Implementation Phase in a Change Process

The implementation phase is defined as consisting of “the first experiences of attempting to put an idea or reform into practice” (Fullan, 2001b, p. 69). Giacquinta (1973) perceives it as a process that, when successful, results in the alteration of organizational members’ behaviour and attitudes so that they conform to the expectations of the innovation. Fullan’s model is useful in that it identifies 9 critical factors affecting implementation which are grouped under 3 main categories: the characteristics of the change, local factors and external factors. These are reflected in Figure 2.1 below.

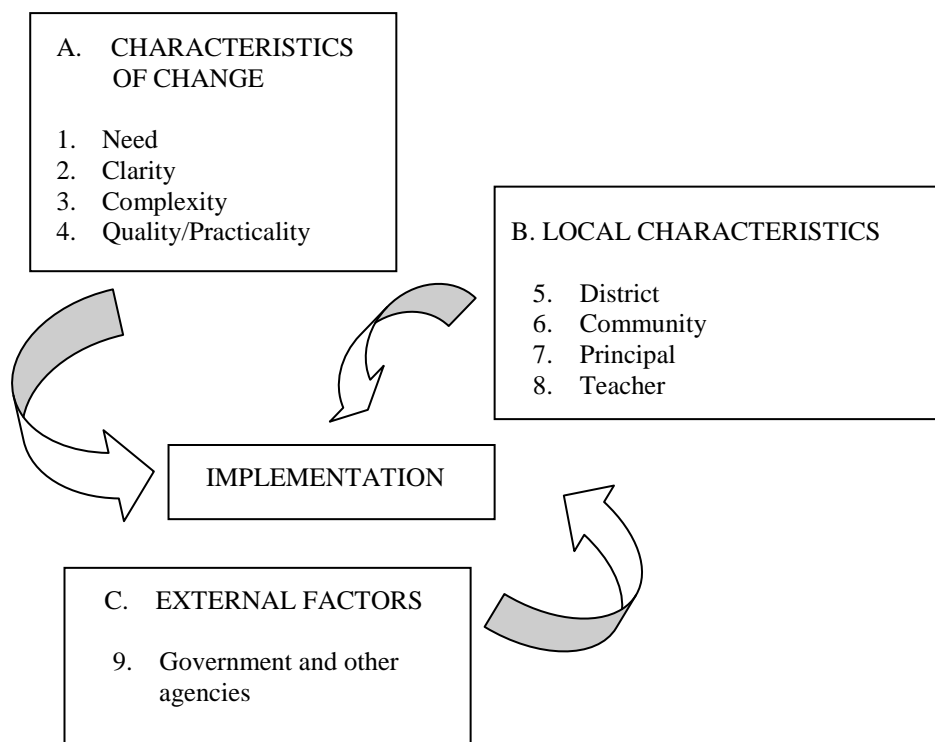


Figure 2.1: Interactive factors affecting implementation (Fullan, 2001b, p. 72)

Basically, this diagram suggests that successful implementation is influenced by the interactions between attributes of change, and variables related to the local context as well as external variables.

2.1.1 The Characteristics of the Change

This category relates to four factors: need, clarity, complexity, and quality.

Need

Fullan (2001b) maintains that consideration of need is an important readiness factor because schools are involved in many improvement agendas. This thus, requires the prioritizing of one need in relation to others. Many innovations apparently fail to consider this. Fullan also points out that people frequently understand their needs better during implementation but not so in the beginning. With regard to ETeMS, it must be said that many still have issues with the need for it. In fact, the issue of need has been the bane of policy makers (see Section 1.4). Fullan explains that needs interact with the other eight factors to produce different patterns during implementation. The interaction either further clarifies or makes it harder to understand need.

Clarity

Clarity is about understanding why change is being pursued and what needs to be changed. This factor is critical to the success of change. It is important that teachers and others understand why there is a need for change and what they should do differently in practice. However, achieving clarity is not straightforward. Fullan (2001b) points out that while changes that are poorly defined can cause a great deal of apprehension and frustration to those genuinely attempting to implement them, greater specificity may result in false clarity. He cited the example of using guidelines in a literal way without attending to the underlying teaching strategies and beliefs that are essential for effective implementation.

One example in Malaysia to illustrate this is provided by Lee (2006) in describing the MOE's effort to increase teacher readiness in implementing the New Secondary School

Curriculum (KBSM) and its teaching methods. She reported that the MOE adopted an in-house training model for this purpose. Select teachers were prepared at the national level to become resource persons before returning to their respective states to conduct similar training. Training packages consisting of sample lesson plans and their video recordings in addition to guidebooks and syllabi documents were supplied to the resource persons and to schools. Principals in collaboration with their resource person were directed to organize on-site training using the training packages. Teachers were also given access to the training packages for independent learning. However, the teachers' use of the materials did not reflect deep understanding of the underlying philosophy because the training packages did not deal with the theoretical underpinnings of the syllabi or suggested pedagogy. Fullan (2001b) explains that achieving clarity is dependent on the process. He states that simple and small changes can be understood and accepted readily but the more involved and important ones may not be willingly accepted or be influenced by simple explanation.

Complexity

Fullan (2001b) defines complexity as “the difficulty and extent of change required of the individuals responsible for implementation” (p. 78). Giacuinta (1973) explains this best when he identifies three critical personal attributes that must be present within the change agent at the classroom level: understanding of innovations, ability to exhibit the attitudes, values, and behaviour required, and willingness to make the necessary efforts; all of which accord with Fullan's view. Fullan believes that change at the classroom level can be studied in terms of skill required, difficulty, and degree of alterations in teaching strategies, use of materials and beliefs. He was encouraging when he stated that although complexity makes implementation problematic, change may be great when more is attempted. This can be especially rewarding when changes are successful as the difference can be great. However, we also have to be mindful as the flip side is

also true. What this means is that because complexity may determine the speed and extent to which change in schools occurs, it is crucial for change projects to give due attention to the enhancement of the personal attributes of the implementers. The complexity issue is an important one for all change agents of ETeMS. However, it has particular significance for those teacher change agents who are limited in their English proficiency.

Quality and Practicality of the Program

This last factor under the nature of change relates to issues about materials and other resources. Fullan (2001b) makes an important point by stating that the quality of the change is sometimes overlooked when emphasis is placed more on initiation rather than implementation. He draws our attention to ambitious projects where adoption is drastic, leaving insufficient time for deliberation on matters of teaching and training materials. This was certainly the case with ETeMS.

The in-house training strategy for disseminating information about KBSM during its nationwide adoption reported is also relevant here. Lee (2006) reported that part of the weaknesses of the strategy which utilized training packages was that the training packages were standardized and ignored varying teacher competencies or contextual differences between schools.

Fullan (2001b) is correct when he states that it is necessary to combine ambitious projects with quality but accomplishing this does not come from telling or showing people what to do. Substantial change, according to him, must be attempted by working persistently on multilevel meaning across the system over time.

2.1.2 Local Factors

According to Fullan (2001b), local factors relate to the local school system which represents a major set of situational constraints or opportunities for effective change. He rightly reminds us while “the individual school may be the unit of change, but frequently change is the result of system initiatives that live or die based on the strategies and support offered by the larger organization” (Fullan, 2001b, p. 80).

The School District

Fullan (2001b) has found evidence that while change can be effected by individual teachers and schools, the change will not be district-wide without support from central administrators. Additionally, it is important to remember that only paying lip service to a change initiative is insufficient to promote change in practice. This is because teachers do not “take change seriously unless central administrators *demonstrate through actions* that they should” (emphasis in original, Fullan, 2001b, p. 81).

It needs pointing out that the school district, locally known as the District Education Office (DEO), works differently in Malaysia. As explained by Lee (2006) DEOs function as a go-between for administration at the state and school levels. Their roles include:

- supervising schools, teachers and pupils at the ground level
- establishing good relations with parents and communities
- collecting data on schools, teachers, and students for use by the State Education Department (SED) to make decisions
- conducting routine tasks such as maintenance
- monitoring public examinations

Clearly, DEOs do not participate in decision-making at the SED. In fact, they continue to have little say in local decision-making in educational matters despite their

establishment throughout Malaysia. “In the Malaysian context, the local district authority is very weak” (Lee, 2006, p. 152). Additionally, we have been informed that DEOs lack the requisite skills and knowledge for data analysis, teacher supervision and teacher professional development because the majority are former school teachers with limited experience in these areas. Lee (2006) believes that for the DEOs to be effective in their roles, they need proper training in order to develop their professional skills and knowledge.

School Board and Community Characteristics

In Fullan’s assessment, the role of communities and school boards (i.e. the Parents’ and Teachers’ Association in the Malaysian context) vis-à-vis implementation is not easy to generalize. However, it is believed that the role of communities and school boards is quite variable ranging from apathy to active involvement.

Kamwendo’s (2005) study is referred to for an excellent example of a community’s effort at contributing towards implementation. After the Malawi government issued its directive to use mother tongue for teaching grades 1-4 in 1996, the Chitumbuka Language and Culture Association (CLACA) actively tried to ensure a high degree of readiness for the use of Chitumbuka in schools. In order to obtain new improved textbooks for use when the policy is enforced, CLACA gathered old Chitumbuka textbooks used in schools prior to the 1968 ban on the language to help in the revision. In addition to recommending books for the proposed mother tongue policy, the association submitted a proposal to the MOE suggesting ways to select Chitumbuka-medium instruction textbooks.

In Malaysia, active involvement at the implementation phase by the community in this way is rare. Support from the community is usually in monetary form.

The Principal

Fullan (2001b) observes that we are increasingly engaged in reforms which are large in scale. He believes that such reforms are complex and their success is greatly influenced by what the principal does. Fullan's revelation of the four ways in which school leadership is complex is useful. Firstly, the changes we are seeking are deeper than we first thought. Secondly, this presents several dilemmas in decision-making, requiring different courses of actions for different situations or phases of the change process. Finally, the complexity means that only advice in the form of guidelines for action can be given rather than steps to be followed.

In dealing with the first complexity, principals need to be skilled in reculturing schools, that is, aiming for a deep and lasting change. In Belchetz and Leithwood's (2007) model this dimension of practice is referred to as setting directions. The emphasis in this dimension, according to Fullan (2001b), is developing new learning cultures where many teachers work together to find collective meaning and commitment to new ways (i.e. professional learning communities) with student learning as the focus. This implies moving towards a broader view of learning rather than the superficial learning aimed at increasing scores on achievement tests. For principals in Malaysia this is going to be a challenge as part of their role, in the past and is still true now, has been as instructional leaders supervising and guiding teachers to ensure quality delivery of core activities in schools (Lee, 2006). Even then many are not adept at playing the role as Good and Brophy (2000) note:

Many principals have been trained primarily as managers rather than as instructional leaders; hence, some of them do not have the skills necessary to observe teachers and to provide them with information about their classroom behaviour. Most teachers welcome ideas from principals about how to improve their work, but they rarely receive them. The average teacher is visited by a supervisor only once year and then receives only general and vague feedback...Principals need to develop skills for this role by reading recent books on teaching, curriculum, and supervision...If principals are to support in teacher performance, they must become knowledgeable about aspects of effective teaching, observational analysis, and good clinical skills for interacting with teachers (p. 498).

In addition to the above, the inability to supervise and guide teachers within the Malaysian context is because principals are no longer required to teach, which makes them less sensitive to the intricacies of life in the classroom.

Principals now are expected to be educational leaders who enable teachers to learn and collaborate effectively to enhance professional practice and student learning. But it has been observed that candidates for the post and in-service principals are often poorly prepared for the role. Furthermore, while they are expected to manage a myriad of demands of the job, they receive little support to develop the learning culture in schools (Davis et al., 2005). Fullan (2001b) also warns that developing professional communities is not without dilemmas. It is critical that principals find coherence and work on connectedness (Fullan, 2002) in the reforms they engage in by aligning activities in the school with the school improvement (Belchetz & Leithwood, 2007) as it is a mistake to take on too many projects. Unfortunately, consideration such as this is beyond the jurisdiction of public school principals in Malaysia as part of their functions is “to implement *all* the educational programs stipulated by the Ministry of Education” (Lee, 2006, p. 151, emphasis added). This weakness must be addressed urgently, as the new leadership role for principals, says Fullan, requires that they know how to manage dilemmas and paradoxes.

Effective principals combine different leadership characteristics depending on the phase of change or on circumstances over time. This necessitates the understanding of the change process and the problems and needs that teachers may have. In Belchetz and Leithwood’s (2007) leadership model, this falls under *helping people* which comprises providing individual support/consideration, intellectual stimulation and providing an appropriate model. Principals can be assertive when it is appropriate to do so or supportive when a situation calls for such behaviour. This is necessary in order for

reform-minded principals to manage and monitor the change process to make sure it is always moving forward.

The Teachers

It is widely acknowledged that teachers are central to the process of change at the classroom level (Fullan, 1993b, 2001b; Guskey, 1986; Hill, 2007; Peers et al., 2003). Fullan (2001b) states that educational change is greatly determined by teachers' performance and beliefs. He, however, notes that the conditions of teaching have deteriorated and many teachers are frustrated, bored and burned out. We have also been reminded that although we sometimes long for a change in our circumstances, for the most part we cling reflexively and tenaciously to things as they are (Evans, 1996; Fullan, 2001b; Peers et al., 2003). This is because change frequently entails uncertainty and confusion; it devalues current skills but requires new competence. Feeling a sense of loss, thus, is common for those who must implement change (Evans, 1996). This is indeed true for many teachers who have to implement ETeMS particularly so for those whose command of English is poor. It is critical to rectify this as part of reform effort because teachers need to be empowered to deal with change. Furthermore, we know that while curriculum change can be mandated through new syllabi and associated documents, change in teachers' classroom practice and beliefs are more complex (Peers et al., 2003). Fullan suggests that we begin with developing collegiality:

Change involves learning to do something new, and interaction is the primary basis for social learning. New meanings, new behaviours, new skills, and new beliefs depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support, and positive feelings about their work. The quality of working relationships among teachers is strongly related to implementation (Fullan, 2001b, p. 84).

Evans (1996) concurs with Fullan when he says that educational transformation can be achieved by replacing traditional management with "shared governance and professional teacher isolation by collaboration and collegiality" (p. 68). The importance of collegiality is also expressed by Good and Brophy (2000) who advocate teachers

working jointly to build a favourable school environment. They suggest individual teachers start by striving to develop an effective classroom as a basis to help other teachers understand what they are doing in their classrooms. Through working with peers, teachers can exchange ideas and improve instruction.

The literature provides several models of collegiality such as mentoring (Gustafson et al., 2002), coaching (Hiebert et al., 2002) and lesson study (Hiebert et al., 2002; Lewis, Perry & Murata, 2006). The evidence of their effectiveness has also been documented. Peers et al.'s (2003) report on one primary teacher's professional growth while implementing a unit of work from a newly mandated science syllabus is revealing. The teacher in his study gained from attending professional development workshops and from ongoing guidance of a researcher. Watching videos about science teaching and the ensuing discussions at the workshops (also attended by his colleagues) allowed him to develop knowledge of the new syllabus and to gain insights into teaching approaches that reflect the change. He saw alternative visions of science education and benefited from practical examples on ways to modify his own practice. Besides the discussions during the workshops, everyday conversations with interested colleagues challenged his views and helped him to reconsider aspects of his own teaching. He also reported successful experiences which motivated him to continue to engage with change.

In China, collegiality that contributes to teacher professional development comes in the form of lesson explaining. Peng (2007) describes how this is done among Mathematics teachers:

Usually based on the understanding of mathematics, the explaining teacher designs the lesson independently and explains it orally and publicly in an open environment to the mathematics experts and a group of interested mathematics teachers. Questions relevant to the mathematics lesson will be raised and discussed by the participating teachers, during which the explaining teacher is encouraged to reflect. New understandings of mathematics epistemology and new ideas of teaching design, both for the explaining teacher and the participating teachers, will then be developed (Peng, 2007, p. 291).

These examples reaffirm the belief that collegiality is full of potential for transforming schools as it enriches not only the quality of teachers' work lives but also their classroom practice. However, as encouraging as these examples are, we have to remember that not all collaboration is powerful. As several authors have pointed out sometimes teachers' collaborative work may result in the reinforcement of each others' bad or ineffective practices (Evans, 1996; Fullan, 2001b). Furthermore, not every teacher is interested in collaboration as it means more work to existing workloads. If it were made to become part of the school culture teachers may end up just going through the motions by participating passively. The fact that most teachers work alone may make isolation resilient therefore, making it difficult for collaboration to take root. It is certainly true when Evans (1996) states that the relation among teachers is more often congenial rather than collegial. So, collaboration may take some getting used to. These are concerns which need to be addressed by principals. However, there is a limit to what principals can do individually. Principals and teachers need support in implementing change and one source of support comes from external change agents.

2.1.3 External Factors

Fullan (2001b) believes that the larger infrastructure matters in working towards educational change particularly, in large-scale reforms. Thus, he has included the role of the government and other agencies, referred to as governments, as necessary in implementing change. Governments may comprise the offices of the MOE, faculties of education, and other regional institutions as is the case in Malaysia.

Government and Other Agencies

Fullan (2001b) states that governments can push accountability, provide incentives (pressure and supports), and/or foster capacity-building. Pushing only the first two, he

warns, will not result in deep and lasting change. What is needed is to do all three. He observes the tendency for many governments to emphasize accountability. Very few it appears are good at combining pressure and support, and none have seriously affected capacity although several are working on it. This deserves attention as capacity-building is a requisite component for successful implementation. It may be a good idea for governments to start by shifting away from structural changes and move towards cultural changes in their relationship with local change agents.

Fink (2001) points out that there is a deep disconnect between policy makers and the people who have to implement them. Referring to this reality as the “two solitudes” he reported that their relationship is more in the form of episodic events than processes. This cannot be allowed to continue as Fullan (2001b, p. 87) has informed us that “Not only is meaning hard to come by when two different worlds have limited interaction, but misinterpretation, attribution of motives, feelings of being understood, and disillusionment on both sides are almost guaranteed”. The disconnection is likely the result of the external agents’ inclination to regard principals and teachers as merely implementers of educational policy rather than partners in decision-making. This perception makes it easy to expect the local practitioners to just get on with the job of implementing change. The external agents, in contrast, concern themselves with the provision of training and assessment of schools and teachers’ enactment of change. This line of thinking, typical of the rational linear intellectual paradigm, assumes that principals and teachers are mechanically implementing policy, but they are not.

It is believed that teachers acting as policy makers are prevalent in the implementation of ETeMS. This is implied by the Minister of Education when announcing the reversal of the policy (Husna, 2009, p. 2):

He said the cabinet made the decision after looking closely at the findings of studies and observations on PPSMI (the Malay acronym for ETeMS) which have shown that its implementation could not achieve the desired results. “What has been implemented was PPSMI/BM, whereby teachers were teaching science and maths in both languages, English and BM,” he said.

Although it is convenient to blame teachers for failure in implementing ETeMS, the MOE must acknowledge its own failure to support teachers. For example, in a survey related to professional preparation for ETeMS involving 72 teachers teaching mathematics or science, Noraini and colleagues (2007) reported that both the pre-service and in-service training teachers received could not develop their confidence in speaking English. Teachers also expressed the need for training in helping the learners to learn through English. Mohamad Fadhili et al. (2009) reported a similar request in their study involving 26 teachers. They investigated teachers’ reactions to ETeMS, the problems they faced and the availability of language support systems. The findings revealed that teachers were generally receptive to ETeMS but voiced their need for sustainable measures to improve their language ability and delivery. For many teachers the English language enhancement programme was the *only* course that tried to provide this support. As pointed out by Clark (1992, cited by Noraini et al., 2007, p. 103), “it is impossible to create a single, centrally administered and planned programme of professional development that will meet everyone’s needs and desires”. Hence, it is understandable when teachers engaged in minimal interaction with their students or code-switched (Ong, 2004) or opted to click and show and allowed the voice-over found in the courseware supplied to them to explain science concepts (Sophia et al., 2009) to make up for their inadequacies.

It is evident that governments need to go beyond accountability and incentives. And for this, they must be prepared to work hard as Fullan (2001b) promises that combining accountability, incentives and capacity-building is exceedingly difficult. However, he has a useful suggestion in the form of a two-phased process. Start with accountability

and incentives in phase one and build in more and more capacity-building structures as phase one becomes successful. Governments must heed this advice as those who must implement change must move from “loss to commitment, from old competence to new competence, from confusion to coherence, from conflict to consensus” (Evans, 1996, p. 55) if we hope to establish commitment which is central to institutionalization, the next phase in the change process.

2.2 Eight Lessons on Change

Implementation and continuation are difficult but fortunately, Fullan (1993a, pp. 21-22) has provided eight basic lessons for thinking about change:

- | | |
|---------------|--|
| Lesson one: | You can't mandate what matters (The more complex the change, the less you can force it) |
| Lesson two: | Change is a journey, not a blueprint (Change is non-linear, loaded with uncertainty and excitement and sometimes perverse) |
| Lesson three: | Problems are our friends (Problems are inevitable and you can't learn without them) |
| Lesson four: | Vision and strategic planning come later (Premature visions and planning blind) |
| Lesson five: | Individualism and collectivism must have equal power (There are no one-sided solutions to isolation and groupthink) |
| Lesson six: | Neither centralization nor decentralization works (Both top-down and bottom-up strategies are necessary) |
| Lesson seven: | Connection with the wider environment is critical for success |
| Lesson eight: | Every person is a change agent (Change is too important to leave to the experts, personal mind set and mastery is the ultimate protection) |

2.3 Teacher Professional Development

The researcher is convinced that even with a well-conceived curriculum in place but if the key hinge, the teacher, is flawed, the success of its execution is put at risk. The teacher's ability to be effective deliverer of the curriculum becomes suspect. Diana Kasbaum, a Mathematics specialist, as quoted by Borsuk (2003, p. 2) reinforces this belief, “You can give a great program to a lousy teacher, and it won't go anywhere.” Cognizant of the fact teachers can be policy makers in practice (Croll et al., 1994) whose actions can produce unintended consequences (Darling-Hammond, 1990; Fink,

2003), many professional development approaches and strategies are currently being adopted. This must be seen as a step towards the right direction to empower teachers to act in ways which accord with policy visions.

The mounting literature on educational change has informed us, and I concur, that change requires new knowledge and skills besides change in beliefs and attitude. Furthermore, teachers are not likely to succeed in their attempts at making changes without support and guidance (Fullan, 2001b; Goodnough, 2008; Guskey, 1986; Peers et al., 2003). To ignore these views may be perilous especially since Hill (2007) has drawn our attention to the fact that teachers' education is far from complete when they enter the workforce. Furthermore, writing on the same subject with regard to science education, Akerson (2005) states that the introductory science courses elementary teachers take during teacher preparation "often do not suit their needs or interests and do not contribute to their knowledge of science content" (p. 245). This implies it is imperative for teachers to engage in continuous learning, more so, within the context of change.

While Darling-Hammond (2000) reveals that a strong correlation exists between teacher classroom performance and teacher knowledge of subject matter and, particularly, the knowledge of teaching and learning gained through teacher training, Hill (2007) has made some uncomplimentary remarks about professional development. Through her examination of the effectiveness of graduate coursework and professional development she points out that:

...much graduate coursework appears to be of low intellectual quality and disconnected from classroom practice. Most research finds no link between teachers' graduate degrees and student learning unless the degree is in the teacher's primary teaching field (p. 111).

She further adds that:

Most workshops, institutes, and study groups appear to be brief, superficial, and of marginal use in improving teaching. But it does not have to be this way... Professional development can enhance teaching and learning if it has three characteristics. It must last several days or longer; it must focus on subject-matter-specific instruction; and it must be aligned with the instructional goals and curriculum materials in teachers' schools...To make continuing education effective, school districts should encourage teachers to take graduate coursework that is more tightly aligned with their primary teaching assignment. And districts should select professional development programs based on evidence of their effectiveness (p. 111).

Fullan (2001b) also shares similar dismal feedback relating to in-service training: "Most professional development experiences for teachers fail to make an impact" (p. 255). After conducting a review of in-service programmes he concluded that one-shot workshops were ineffective.

Guskey (1986) offers two reasons why professional development projects failed. He argues that one reason is they ignore the reasons which motivate teachers to engage in such programmes. He maintains that teachers are interested in participating because they believe they have potential to expand their knowledge and skills; enhance their effectiveness with students; and provide practical ideas that are relevant to daily classroom work. Also persuasive is the explanation by Good and Brophy (2000) that teachers find in-service training programs boring and a waste of time usually because the programmes are unrelated to their needs. Professional development programmes also failed when due consideration is not given to the process of teacher change. Guskey (1986) observes that professional development frequently begins with an attempt to change teachers' beliefs, attitudes and perception. This is based on the assumptions that teachers' beliefs and attitude must change before teachers can change their classroom behaviour and practices. When change is successful, student learning is improved. However, the assumptions are debatable and may even be inaccurate based on current research on teacher change.

This researcher is of the opinion that perhaps, a third reason can be proposed; one which has to do with the way professional development is conceptualized. The MOE in Malaysia perceives professional development as:

...programmes that aim to upgrade graduate and non-graduate education officers academically and professionally. To this end, the MOE conducts certificate courses and in-service 14-week courses (Ministry of Education, 2001, p.47).

A weakness in this approach relates to the issue of ownership. Developing a sense of ownership of a change project is crucial as without it teacher commitment is unlikely. Ownership develops gradually as teachers continually work on agendas that are relevant to them rather than “to discuss agendas determined elsewhere and present knowledge about practice that is mediated and pre-digested by others” (Saavedra, 1996, p. 273). Good and Brophy (2000) rightly remind us that teachers who plan their own in-service training typically take the task seriously and work earnestly to develop useful programs. Thus, the notion of professional development as defined by Fullan (2001b) should be the preferred choice. According to Fullan, “Professional development is not about workshops and courses; rather, it is at its heart the development of habits of learning that is far more likely to be powerful if they present themselves day after day” (p. 253).

Although the arguments that have been presented are compelling, the education authorities in Malaysia seem incognizant of them. The former Education Minister had announced that in a bid to enhance the standard of the teaching profession, all teacher training colleges would be upgraded to university status (Mohd Hamzah, 2004). The upgrading, it was reasoned, was to enable the institutes to offer degree programmes in order to produce more teachers with university degrees. It is rather naive of him to expect such a superficial change to produce quality teachers or make a difference to the quality of education. Furthermore, it suggests that the degrees offered are essentially

unearned and given for a fee (Hill, 2007). It implies that teachers only need to get a place at a university and they are assured of a graduation scroll.

2.3.1 Professional Development under ETeMS

In response to critics who pointed out that Malaysia does not have the right infrastructure or sufficient trained teachers for successful implementation of ETeMS, the MOE put several measures in place for the purpose of teacher development. These include the language enhancement course (ETeMS), Language Immersion Programme (LIP), the buddy support system, and the individual self-learning packages. However, previous studies have reported that the impact of these mechanisms on classroom practice appeared minimal (Ambigapathy & Revathi, 2004; Isahak et al., 2008; Mohamad Fadhili et al., 2009; Noraini et al., 2007; Ong & Tan, 2008). Several studies highlighted teachers' woes in negotiating the change in language of instruction despite their ETeMS training. In their studies, Ambigapathy and Revathi (2004), Mohamad Fadhili et al. (2009) and Noraini et al. (2007) reported that although ETeMS managed to increase teachers' confidence in coping with the change, it was insufficient to enable them to teach in English. Teachers continued to be plagued by their deficient language skills. Ambigapathy and Revathi (2003) reported that teachers were still unclear about the linguistic features of their content subject. Elsewhere (Ong & Tan, 2008), teachers were reported facing problems in managing the number of new English words to be learnt in addition to problems associated with the correct use of these words. In examining teachers' experience implementing the ETeMS policy, Ong and Tan (2008) disclosed that the majority of the teachers (85.2%) in their study had difficulty explaining concepts in English. The teachers (81.8%) stated that reverting to Malay was inevitable in order to avoid communication breakdown when using English.

The buddy support system, it was reported, did not make much impact on teachers' practices. Time constraints appear to impede the true workings of the system. Ong and Tan (2008), and Yeow (2003) found that both critical friends and their buddies had difficulty setting aside time to meet due to heavy workloads. It is interesting to note, however, that even when teachers did manage to meet, according to Ambigapathy and Revathi (2004), consultation was limited to issues relating to vocabulary and grammar or translation as reported by Yeow (2003). Yeow (2003) added that teachers were not used to the idea of seeking help and were not comfortable with critical friends sitting in to observe their lessons. As critical friends were English language teachers, they were unable to give assistance or feedback on matters related to content specific language or pedagogy. In addition to these weaknesses, Yeow (2003) highlighted the absence of a mechanism to monitor the system. The buddy support system as practiced in the schools today does not seem to reflect the vision of its designers from the English Language Training Centre.

Several change theorists have stressed the value of individual teacher learning during the process of change (Evans, 1996; Fullan, 2001b; Saavedra, 1996). Saavedra's (1996) views on teacher learning through reflection are worthy of contemplation. She argues that:

Reflection is a necessary professional responsibility for teachers. It is important for teachers to take time to reflect upon their discussions, readings, observations, interactions with students or peers, and the different contexts in which these events occur. Generation (of new knowledge) is a result of reflective action that leads to shifts in knowledge, belief, and future action (p. 274, bracketed information is added).

Unfortunately, it appears that among Malaysian teachers self-learning is still an issue that needs to be addressed. Lack of time is often cited as the main impediment to sustained engagement (Ambigapathy & Revathi, 2003; Choong, 2003). Perhaps, putting pressure on teachers may be necessary to nudge them to take up the idea of independent learning seriously. After all, "when change occurs it is because some pressure has built

up that leads to action” (Fullan, 2001b, p. 91). Teaching science through English demands instructional practices that are different from those used in teaching science through the mother tongue. In science through English the role of the teacher is twofold: to teach science and to support students’ learning of English. In order for teachers to transition old practices to ones that are in tune with their new role, teachers are duty bound to appreciate opportunities to continually learn. Only through continuous learning will there be hope for teachers to enhance their knowledge growth to deal with the challenges posed by teaching science through English.

2.4 Teacher Knowledge

Shulman (2004) believes that teachers need among others, content knowledge, pedagogical knowledge and curricular knowledge. His conceptualization of the notion of pedagogical content knowledge (PCK), which spurred interest in studies of teacher knowledge in teaching, helps us to see that teaching requires a knowledge base comprising of an amalgamation of content and pedagogy. His model which was further refined by Turner-Bisset (2001) has been adopted for the theoretical framework for this study.

2.5 Turner-Bisset’s Model of Knowledge Bases for Teaching

The Turner-Bisset (2001) Model of knowledge bases for teaching was first developed for a doctoral study which revolved around primary school teachers learning to teach. It had since been fine-tuned based on experiences gained through extensive involvement in educational events and through teaching in primary classrooms. Based on her review of the literature on the notion of teaching and effective teaching Turner-Bisset (2001) argued that the criteria used to define or describe teaching or effective teaching in the past was flawed because there was a tendency to focus only on some but not all of the

knowledge bases teachers need for teaching. She postulates that there are several bases of knowledge for expert teaching and these knowledge bases intertwine in various combinations to inform decisions pertaining to teaching, material selection, teaching approaches and organizational strategies. She, like Shulman (2004), refers to the amalgamation of knowledge as pedagogical content knowledge. The following are the knowledge bases in her model:

2.5.1 Substantive Knowledge

Substantive knowledge in Turner-Bisset's (2001) model of teacher knowledge bases refers to both the facts and concepts contained within it and the frameworks or paradigms used to organize its ideas and information. She believes that organizing frameworks are useful ideas because they shape conceptualization and reasoning. The frameworks also guide enquiry in the sense that they can influence the kind of data or evidence collected, and the observations made.

The study by Ma (1999) is revealing. Ma asked teachers from China and the USA to divide $1\frac{3}{4}$ by $\frac{1}{2}$ and explain how this would be taught to students. All 72 teachers from China answered correctly but out of 21 American teachers, only 9 got the right answer. In addition, 65 Chinese teachers generated over 80 story problems explaining the process through ways that were not only creative, but also appropriate and easily understood. In contrast, only 1 American teacher could describe a conceptually correct method of teaching the same mathematical problem. This led Ma to ask, "without a clear idea of what to teach, how can one determine how to teach it thoughtfully?" (Ma, 1999, p.149).

This implies that the substantive knowledge teachers possess may influence the quality of their instruction and indirectly impacts on students' learning.

2.5.2 Syntactic Knowledge

Turner-Bisset (2001) defines syntactic knowledge as “the procedures, the means and processes by which accepted ‘truths’ have become accepted” (p. 26). In science this would entail the science process skills. For Shulman (2004), the syntactic structure of a discipline is like grammar which provides the basis “for determining what is legitimate to say in a disciplinary domain and what “breaks” the rules” (p. 202). Wilson and associates (1987) explain it as the ways in which the discipline creates and evaluates new knowledge.

Understanding syntactic structures is important for teaching in light of the inquiry approach for the teaching of science prescribed by the MOE. The approach which emphasizes thinking skills, thinking strategies and thoughtful learning necessitates a change from the old ways of teaching. Teachers who understand syntactic knowledge would certainly teach science differently but what happens when the medium of instruction gets in the way? This is one of the issues that this study explores.

2.5.3 Beliefs about the Subject

Turner-Bisset (2001) perceives beliefs about a subject to belong to subject matter knowledge along with substantive and syntactic knowledge. She explains the importance of this knowledge in the following:

Beliefs about a subject are informed by one’s knowledge of the substantive and syntactic structures of that subject. The same is true of education and teaching. If one believes education to be training, this belief shapes one’s thinking, discourse and actions within education. If one believes teaching and learning to be a simple matter of transmission of knowledge, this belief too will shape one’s thinking, discourse and actions in the classroom (Turner-Bisset, 2001, pp. 11-12).

She provided an example from her own study to demonstrate the power of beliefs about a subject and its impact on teaching. She described how a student teacher taught a lesson on investigative mathematics without appreciating the kind of activity the

students were pursuing because of her conflicting beliefs about the nature of mathematics.

2.5.4 Curriculum Knowledge

Turner-Bisset (2001) describes curriculum knowledge as “all the materials and resources which might be used to teach aspects of the curriculum” (p. 14). This concept is a broad one as it includes home-made materials devised for use with a particular context or set of learners in mind. Wilson et al. (1987) share the same view when they state that teachers use various kinds of knowledge when deciding on the content of their courses and one of the knowledge bases according to them is curricular knowledge. They define this knowledge as the teachers’ “understanding of the programs and materials designed for the teaching of particular topics and subjects at a given level” (p. 114). Shulman (2004) sees curriculum and the materials available for each subject as the tools of teaching. He likens a teacher who has a limited understanding of the materials for instruction to a physician who knows only one way of dealing with categories of infectious disease because he does not really understand alternative ways.

Curricular knowledge is a significant teacher knowledge in the current study especially since most teachers have no or limited experience talking about science through English. For these teachers, the use of alternative materials like pictures, models, videos and interactive technology would be useful to complement their teaching especially when their skills of verbal explanations in English are limited.

2.5.5 General Pedagogical Knowledge

General pedagogical knowledge is the “generic knowledge about teaching gained from practice” (Turner-Bisset, 2001, p. 15). This includes knowing about how to settle a class, how to attract and hold attention, and how to manage resources.

Findings by Berliner (1987) in a study of ways of thinking about students and classrooms by more and less experienced teachers should be of interest to individuals who are inclined to think that possessing subject matter knowledge alone is enough for a person to be employed as a teacher. He discovered that the postulants in his study comprising of mathematicians and scientists with some informal experience in teaching young people but with no formal classroom teaching experience “appeared to be ignorant of classroom realities” (p. 77). This led him to make the following comments:

Some state legislators, superintendents on instruction, and governors...have programs to provide teaching certification to individuals, like our postulants who possess subjects matter content knowledge. Our data inform us that such a policy could be dangerous. It denies that there is any sophisticated knowledge base needed for classroom teaching. It is interesting to note that no one who has great knowledge of flying and who may even be able to pilot a Cessna airplane believes they can walk into the cockpit and fly a Boeing 747. But the myth persists that anyone who has subject matter knowledge can teach. That belief shows both ignorance and arrogance. Our work leads us to believe that most content matter specialists in mathematics and science who have only industrial and research experience are profoundly ignorant about important characteristics of classroom functioning (Berliner, 1987, p. 77).

This excerpt underscores the need to respect teaching as a demanding, multi-faceted activity. While it is important for teachers to have deep understanding of subject matter content, they also need other knowledge bases which among others include pedagogical knowledge, curriculum knowledge and skills in classroom management. This is because teaching is more than just imparting information about a particular subject. LEP teachers in this study would do well to remember this as it has been shown that the focus in ETeMS classrooms “tends to be predominantly on content and not language” (Tan, 2011, p. 336).

2.5.6 Knowledge/Models of Teaching

This knowledge base is also described as beliefs about teaching and learning (Turner-Bisset, 2001). It refers to ideas about how children learn and of what teachers do to promote student learning.

- **Learning**

Turner-Bisset asserts that knowledge and understanding of how children learn develops from one's personal experience of learning, and of observing and teaching children; and through reading and ideas from courses. Turner-Bisset recommends having understanding about a range of theories of learning rather than subscribing to one particular theory. This, she states, increases one's options for enabling children to learn besides offering a framework to analyse one's own practice. She suggests reflecting on one's own experiences of learning and applying some or all of the theories of learning to episodes of learning.

- **Teaching**

Turner-Bisset (2001) believes that any debate on effective ways of teaching should address the question of pedagogical repertoire. She perceives this notion as consisting of two aspects. The first comprises approaches, activities, examples, analogies and illustrations for, analogies and illustrations for representing facts, skills, concepts, beliefs and attitudes to others. The second is the skills and strategies used as an integral part of these approaches such as storytelling, Socratic dialogue, drama, role-play, simulation, demonstration, modelling, problem-solving, singing, playing games, and transformation of knowledge into other forms, besides the usual question-and-answer, instructing, explaining and giving feedback on children's oral contributions and written work.

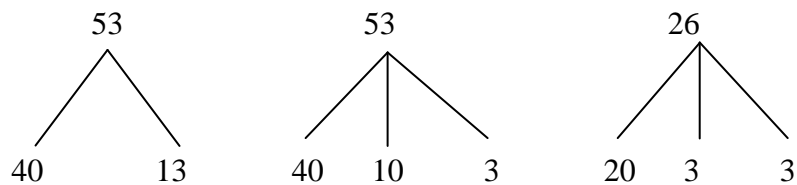
2.5.7 Knowledge of Learners: Empirical and Cognitive

Turner-Bisset (2001) defines empirical knowledge of learners as "knowledge of what children of a particular age range are like; how they behave in classrooms and school; their interests and preoccupations; their social nature; how contextual factors can have

an effect on their work and behaviour; and the nature of the child-teacher relationship”
(p. 15).

Cognitive knowledge of learners includes knowledge of child development and knowledge of a particular set of learners which develops over time through regular contact. While the former informs practice, the latter informs the teacher about what the learners can and cannot do or understand.

The two elements of knowledge of learners are valuable when considering activities or representations for teaching to ensure a good fit between what is chosen and the learner’s state of readiness. Ma (1999) provides an example to show how mathematics teachers can benefit from their knowledge of learners in their classroom practice. In discussing procedure for decomposing a higher value unit in her study, the teachers mentioned various methods of regrouping for the problem of how to subtract 26 from 53.



In the first method 6 can be subtracted from 13, 20 from 40 to get 27. In the second, 6 is subtracted from 10 to get 4, add the 4 to 3 and get 7, subtract 20 from 40, add the 7 to 20 and get 27. The third solution is to subtract one 3 from 50 and get 47. Next, subtract 20 from 47 to get 27. The teachers explained the second and third methods are usually more acceptable to young children because of their limited capacity in mathematics. Additionally, the teachers described the different situations when these methods may make computation easier.

2.5.8 Knowledge of Self

According to Turner-Bisset (2001), there are two aspects to a teacher's knowledge of self. The first is the investment of self in teaching and the second is the impact of teaching on the self. To gain understanding of the first aspect, Turner-Bisset suggested that teachers "reflect on what sort of people they are; which aspects of their personality they utilize most in teaching; and how their personal interests and passions feed into their teaching" (p. 155). As for the second aspect, she suggested examining the kinds of emotions that teaching has engendered in oneself on different occasions. In her own study of student teachers, she discovered that teachers' development, to some extent, is influenced by their ability to reflect on practice.

Osborn (1996) in her book review cited Waller (1932) who points out that teachers and pupils are not 'instructing machines' or 'learning machines'. They are whole human beings locked in a mesh of human connections. Much of the outcomes of education are determined by the quality of these connections. The literature has revealed that this is indeed true (Jeffrey & Woods, 1996; Nias, 1996; Stritikus, 2003). Teachers' sense of self and how they teach are related to their life in the school where they work.

2.5.9 Knowledge of Educational Contexts

This is knowledge of all educational contexts where learning occurs i.e. from nursery settings to the broader educational context of the community and society. In examining the teaching performance of beginning teachers Turner-Bisset (2001) documented that the most successful of them were teachers who prior to training, had exposure to a variety of educational contexts and classrooms. She believes teaching experience accumulated from varied educational contexts contributes toward teacher development and classroom performance besides communication and people skills. Major and

Palmer (2006) provides an excellent example how participants in one faculty successfully reshaped their pedagogical content knowledge because of organizational change and institutional intervention.

2.5.10 Knowledge of Educational Ends

Three kinds of educational ends have been identified under this teacher knowledge (Turner-Bisset, 2001). First, there are the educational ends of society which is defined by the curriculum to achieve particular goals and purposes. The second type of educational ends exists in schools. All schools have some kind of mission statements of what they hope to achieve with the students they have. Additionally, there are expectations and aims that are embedded in the sub-culture of a school. Knowledge of both the explicitly-stated and culturally-embedded educational ends of the school helps teachers to understand what is expected, what is possible and how to fit in. The third set of aims is set by teachers themselves. Turner-Bisset (2001) believes it is important for the individual teacher to examine what his or her educational aims are and to be aware of his or her own values.

2.5.11 Pedagogical Content Knowledge (PCK)

Turner-Bisset (2001) describes PCK as the blending of all the knowledge bases described earlier. She states that teachers develop their PCK over time. She provides several key ideas to fully understand pedagogical content knowledge:

- The key notion of representation which is the summation of all the knowledge bases in action
- The idea of knowledge bases as interacting sets
- The idea that sometimes only some of the knowledge bases work together
- The idea that in an expert act of teaching, all of the knowledge bases are present in the amalgam
- The idea that the knowledge bases are the submerged 'nine-tenths of the iceberg'

(Turner-Bisset, 2001, p. 125)

In his discussion of PCK, Shulman (2004) explains that substantive knowledge is usually not taught in the form it is stored in the teacher's memory. It goes through transformation in order to fit in with different population of students and educational contexts. Teachers may explain the content knowledge or use representations so as to transform their understanding of the content into a form that students can comprehend. He perceives pedagogical content knowledge as a second kind of content knowledge. This notion of pedagogical content knowledge is significant because it implies that teachers must not only have knowledge of their subject matter, they must also be able to explain them in different ways under different circumstances.

2.6 Proficiency in the Instructional Language

In order to execute what has been described by Shulman (2004), the researcher is of the opinion that it is imperative that teachers are proficient in the instructional language. Met (1995) reinforces this belief when she states that “teachers who work with second language students are teachers of *content* as well as of *language*” (p. 160). Met contends that teaching students through a second language requires teachers to be “skilled in negotiating meaning...have well-developed skills in monitoring student performance...be expert in instructional decision making...they must serve as role models for the use of language, cultural behaviours, and learning strategies; and the need to structure the environment to facilitate language learning” (p. 167).

Curtain and Pesola (1994, p. 57) further reaffirm the researcher's belief in the importance of teacher proficiency in the medium of instruction when they suggest that:

In early stages of language acquisition, the teacher actually provides both parts of a conversation. Later, the teacher embellishes one- and two-word responses by the student into complete utterances in a natural, conversational manner, at the same time modeling extended discourse and providing meaningful listening experiences.

Equally convincing is Peterson's (1997) concluding remarks in her study which sought to discover the forms and functions students need to learn for academic success. According to Peterson, it is important for teachers to simplify their input, contextualize new learning, pay attention to the sequencing and recycling of forms, and re-teach concepts in new formats and at new levels of abstraction.

What these scholars (Curtain & Pesola, 1994; Met, 1995; Peterson, 1997; Shulman, 2004) have described is clearly the notion of scaffolding where teachers assist students' acquisition of new skills and knowledge through their talk. Clearly, their opinions provide compelling support for including proficiency in the target language as a significant knowledge base for teachers who are teaching through a second language. Hence, one of the aims of this study is to investigate the role(s) of language proficiency as a crucial teacher knowledge base when a subject (science) is taught through a second language (English). The findings will confirm whether teacher proficiency should be included as an additional component of teacher knowledge bases for expert teaching. A possible model of the teacher knowledge required for expert teaching in an ESL/EFL context therefore may be reflected as follows (see Figure 2.3):

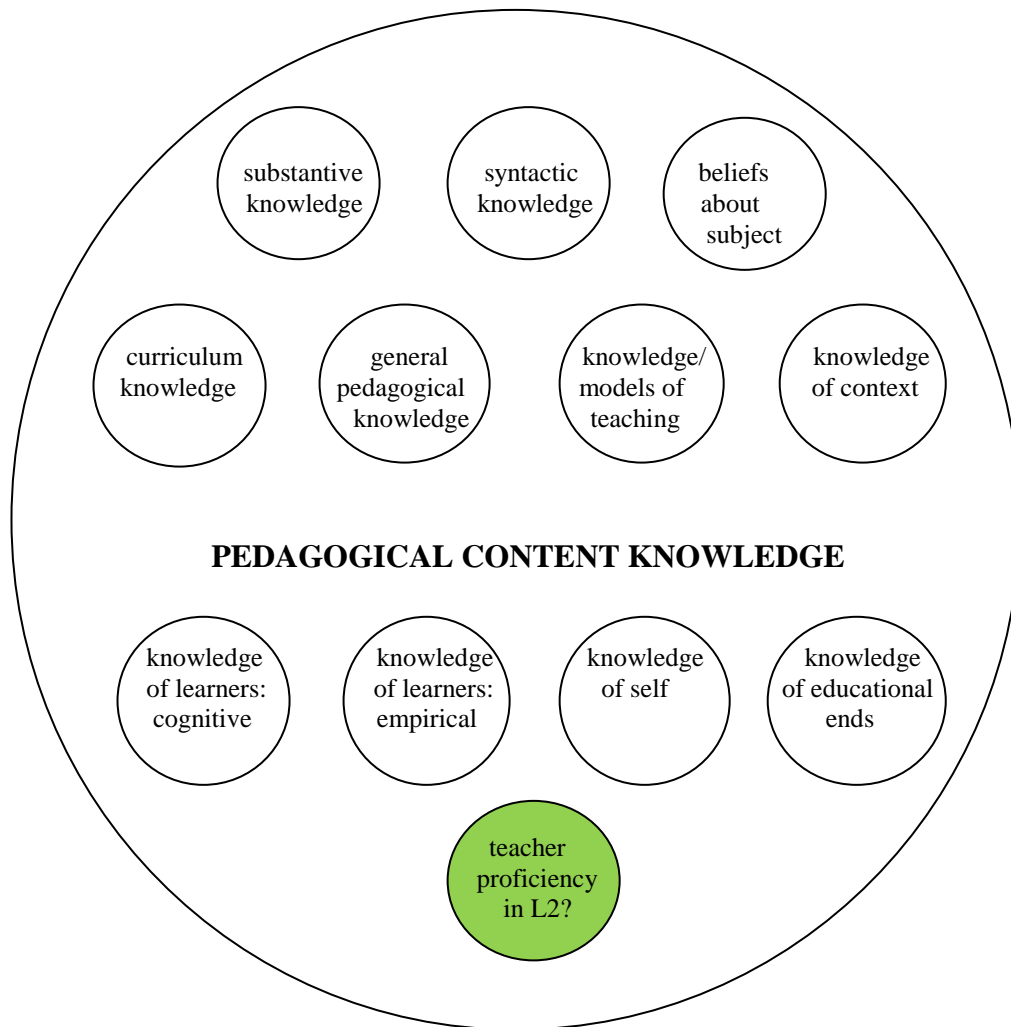


Figure 2.3: A possible model of knowledge bases for expert teaching in an ESL/EFL context

2.7 Issues in Integrating Content and Language

There are many reasons to support CBI (see Section 1.9) but before we rush to implement it, there are also issues that must be addressed. One which concerns teacher knowledge has already been covered. This review will continue with three more problems: conceptualizing CBI, timing and science as a language. It must be pointed out that choosing to focus on these three subjects does not imply that issues such as syllabus and materials design and assessment are not important.

2.7.1 Conceptualizing CBI

The conception of CBI is an important issue for all educators who wish to adopt it. However, it has particular significance for those teachers who are tasked to do so in an ESL/EFL setting. The teachers in the current study can be considered to belong to this second category. These teachers need to be clear about what CBI means in order to apply it appropriately at the classroom level. The issue regarding relating L2 teaching and content teaching deserves serious attention as other decisions should be guided by this consideration. Marsh (2008) reminds us that in relating language teaching and content teaching, the key lies in integration. This is based on the premise that “people do not learn languages, and then use them, but that people learn languages *by* using them” (Eskey, 1997, p. 133, emphasis in original). It follows from this logic that the main focus of CBI should be to provide integration between formal language work and those tasks requiring the use of language which students will face in the target language community (Mohan, 1979). Lidbury and Zhang (2008) in writing about comprehending scientific language help to explain this further. They point out that special languages have emerged along with the development of scientific knowledge and the accompanying growth of new specializations. These specialized languages according to them can be considered as foreign languages as they are aligned to particular special groups and are mostly incomprehensible to people outside these clusters. Thus, for students who aspire to enter any of these communities, learning the language is a must.

Mohan (1979) believes that content classes form an important part of the target language community for the ESL student, and constitute a set of language use tasks crucial to the student’s school progress. He describes three ways in which L2 teaching and content teaching can be integrated:

1. L2 teaching *by* content teaching, in which the focus is on providing content teaching in the L2 with the assumption that the student will learn the language. To this end communication becomes the major focus of language activity;
2. L2 teaching with content teaching, that is L2 teaching is *combined with* content teaching for example teaching students English and science simultaneously;
3. L2 teaching *for* content teaching such as teaching English for special purposes. In this case, the intention is to assist the L2 students' achievement in the content class.

It is believed that ETeMS is based on the first conception and its detractors have seen an inherent weakness in this conception by raising the question: How can the teaching of mathematics and science in English contribute towards the learning of the language? This appears to be a valid question as Mohan too has expressed doubts if teachers and L2 students really communicate in the content classrooms. He argues that using L2 as a medium of instruction does not guarantee successful communication. Mohan (1986) points out that all content learning is language learning. However, the reverse is not true because content learning is often trivialized in language classes. Elsewhere, Marsh (2008) has pointed out that there appears to be widespread belief that teaching content in English is CBI. However, he has explicitly stated that it is not when he explains that:

Teaching in English, without adoption of appropriate language-sensitive curricula and methodologies, inevitably leads to confusion, despair and high drop-out rates. Clil (content and language integrated learning), as in teaching through English, always involves dual-focused aims. In a Clil class, attention is simultaneously given to both topic and language. Colloquially described as using languages to learn and learning to use languages, it can be viewed as the next phase of the 1970s' communicative revolution (Marsh, 2008, p. 1, gloss added).

The above implies that it is very important to be clear about the subtle differences we introduce in the language we use to define CBI. Murphey (1997) warns that CBI does not work when teachers fail to grasp its underlying methodological concept which has its goal to teach language and content simultaneously.

2.7.2 When to Introduce CBI

Besides the short supply of content teachers who can teach through English, the other problem that has been the subject of continuous debates in the implementation of ETeMS is related to timing. Proponents of CBI (Grabe & Stoller, 1997) have strongly recommended that integrated teaching of language and content commence as early as possible for L2 learners. This follows the argument that students' time in school is brief and developing skills in L2 academic language requires time. Thus, students need to learn content *while* they are acquiring the specialized language of the content.

In contrast, research within bilingual programmes indicates that learning should occur first in the mother tongue as a basis to learning in the second language (Gibbons, 2002; Thomas & Collier, 1997-98). Cummins (2001, p. 75) explains that “there is an interaction between the language of instruction and the type of competence the child has developed in his L1 prior to school”. The challenge for the CBI teacher in this case lies in the ability to assist students who appear to be at a disadvantage at the outset because of their under-developed L1 academic proficiency. The work is certainly not easy for the teacher who has not mastered the medium of instruction.

Cummins (2001) had suggested a dichotomy between basic interpersonal communicative skills (BICS) and cognitive/academic language proficiency (CALP). He states that BICS can be acquired in two years while CALP, the more complex of the two, can take between five to seven or more years to develop. BICS, he reasons, is easier to acquire because it is context-embedded and so aids comprehension. Conversely, CALP being context-reduced in the absence of contextual supports and props requires a longer time to develop. Although his theory has invited criticisms it is still relevant for the current study. It suggests that teachers are required to understand the difference between the two in order to determine how their teaching can support

students in acquiring academic styles of language. The success of the students in CBI greatly depends on the teachers' ability to do this well.

2.7.3 The Language of Science

The language of science is an academic language and so it is abstract and context-reduced. It is widely acknowledged that besides words, science use other symbolic tools to perform certain sorts of characteristics activities (Gee, 2008; Lemke, 1998). Lemke (1998), in fact, perceives the use of words, symbols, images, and actions as the languages of science. To learn science, he says is to learn to use all of these languages. Thus, if we see science education as a process of enabling students to acquire these skills, then we must ensure that the teachers we have in our classrooms are also equipped with these very same skills to facilitate the process. The need to equip teachers warrants serious attention as it has been noted that the language of science can also be confusing as some scientific words can have other meanings in everyday usage although they sound the same (Carlson, 2000; Carrier, 2005; Thomas & Collier, 1997-98). The words *chest* and *contract* in the following sentence are some examples: *As we exhale, the chest moves in causing the chest to contract.*

We have also been informed that the grammatical patterns used in the language of science differ from the patterns found in conversational face-to-face communication (Gee, 2008). The frequent use of the passive voice often makes it difficult for some students to sort out the doer of an action. To add to this, objects become animate as seen in sentences such as *Like poles repel*. Gee (2008) provides this short extract from Martin (1990) to enable us to see just how dense the language of science can be:

The destruction of a land surface by the combined effects of abrasion and removal of weathered material by transporting agents is called erosion...The production of rock waste by mechanical processes and chemical changes is called weathering (p. 60).

Gee's unpacking of this text through his explanation of its grammatical features helps us to understand why this text is an example of academic language:

- complex subjects, such as “the production of rock waste by mechanical processes and chemical changes”;
- nominalizations, a word linguists use for verbs that have been turned into nouns, such as “production” rather than “produce”;
- passive main verbs, such as “is called”;
- complex embedding, for example, “weathered material by transporting agents” is nominalization embedded inside “the combined effects of...,” and this more complex nominalization is embedded inside a yet larger nominalization, “the destruction of...”

(Gee, 2008, p. 61)

It is believed that a major difficulty in learning science is learning its language (Lidbury & Zhang, 2008). Attention must be given to learning the language of science in order to improve the quality of science education. In attempting to address this problem, L2 experts have been commissioned to conduct workshops to prepare teachers to work with English language learners. But these workshops, according to Valdes (2004), frequently focus primarily on organization and mechanics. Valdes argues that this may not provide teachers the content-specific instructional strategies they need to teach content and to assist students in developing their English language skills.

It is interesting to note that having the ability to teach content courses through English does not mean that teachers will do so. This appears to be true in a case reported by Murphey (1997) through his study of Japanese teachers. He cited teachers' lack of confidence; feeling uncomfortable and unnatural speaking in English when they could get their message across more easily in Japanese and teachers' perception that students were not linguistically ready to understand content in English as among the reasons for the teachers' reluctance. There were also others who believed they made too many mistakes and would make poor models for their students. His investigation of teachers

at the university level revealed that apart from tradition and the ease of explaining things in English, teachers' reluctance was also attributed to their unwillingness to add more work and preparation to their existing overloaded schedules which was expected with the switch. This indicates the tremendous influence beliefs and attitude as well as knowledge of context can have on teachers' preparedness to make changes to their professional practices.

2.8 Talk in the Classroom

As had been pointed out earlier, under ETeMS, all mathematics and science teachers face the dual task of teaching content and teaching the language to talk about the content. In light of the complexities surrounding the teaching and learning process through a second language and the fallibility of the learners involved, what teachers do toward minimizing the potential of failure is important. Several scholars concur that the rate of success of formal learning can be influenced by the interactions that teachers engage with their students (Myhill & Warren, 2005; Sage, 2006; Townsend & Pace, 2005; Walsh, 2002). This belief has its roots in Vygotsky's theory (1962). Vygotsky suggests that "collaboration with adults who explain, supply information, question, correct, and make children explain provides the structures of adult language and rational thought that children will finally internalize" (Meyer, 2000, p. 228).

Lundsteen (1976) acknowledges the power of collaborating with adults and points out that children learn from adult models who provide the input for them to acquire language. She notes that the sounds that characterize children's dialect are approximately similar to the model or person(s) with whom they have lived. She states that the availability of adults to dialogue with the child is an important aspect of language acquisition. Within the classroom context this implies that it is worthwhile for teachers to invest time and effort towards enhancing their teacher talk.

2.8.1 Teacher Talk: CBI in an EFL/ESL Context

It would be ideal for L2 students to have teachers who are proficient in academic English and who will use it in numerous ways to model its use (Valdes, 2004). But the reality is L2 students often have to contend with teachers who are interlanguage speakers of English (Wong-Fillmore, 1992). Valdes (2004) points out that we still have not seriously examined teachers' proficiency and ease in the target language when discussing about L2 learner acquisition of English. This is ironic as the power of teachers to effect change through their talk is enormous.

Hansford (1988) asserts that:

Communication is the essence of teaching, and many teachers will, or should, spend a large proportion of their professional careers endeavouring to improve both communication skills and knowledge of communication processes. It is vital that teachers have an excellent grasp of their subject areas, but unfortunately a superior knowledge of physics or industrial arts does not imply the capacity to impart this knowledge to others (*ibid.*, p. 15).

In a study examining how different types of instructional strategies impact on interest in science among 13-year-old students in Japan and the United States, House (2003) made two findings which are particularly relevant to this study. He reported that students from both groups stated that their teachers' frequent explanations of rules and definitions when presenting new science topics, and requests for students to share their knowledge about the topics were significantly associated with greater enjoyment for learning science. The students in Japan especially enjoyed engaging in discussions about relevant everyday problems incorporated into their lessons.

In the Malaysian CBI context, interesting findings related to teachers' classroom talk have been reported by Sophia et al. (2010). Through studying primary teachers' use of questions during science lessons these scholars discovered that critical thinking among students was rare as teachers were prone to asking convergent, fact-recalling questions

that solicit short answers. None of the teachers in the study posed questions at levels beyond analyse. In addition, none practised or implemented the strategies they had learned through professional development courses. Teacher talk was still dominant in all the classrooms observed. Sophia et al. conclude that there is “a pressing need for teachers to develop and implement a more efficient strategy centred on meaningful construction of science concepts apart from addressing the challenges of the teaching of science in a second language” (p. 58).

In investigating secondary mathematics and science teachers’ implementation of CBI in Malaysia, Tan (2011) discovered the following:

All classes observed...remained very teacher-centered. Activities that allowed students to verbally or textually explain or explore their conceptions (or misconceptions) of the ideas presented by their teachers, either individually or among peers, were not often seen. Instead, teachers often used translation, simplification or key words as the quickest ways to help students understand (p. 335).

Clearly, the teachers in this study were not carrying out the intentions of the ETeMS policy. Tan explained that teachers’ reliance on quick solutions had to do with their need to complete the entire syllabus in order to prepare students for exams.

Also relevant in this discussion about teacher talk is a study cited by Brenner (1998) which focused on bilingual elementary classrooms. The findings of this study revealed that students did not receive accurate training in the language of mathematics despite being taught by bilingual teachers. It was reported that some teachers who were fluent in Spanish still made errors in their mathematical terminology in Spanish because they never studied mathematics in Spanish. The teachers were also prone to using concurrent translation during instruction but spent little time teaching content in Spanish. Another significant finding was that students’ incorrect use of mathematical terms in English was not corrected by their teachers.

Lack of attention to errors in language use it appears is prevalent in classes where teachers and students have limited English proficiency (Nel & Müller, 2010; Qorro, 2006). In a review of studies on CBI conducted in classrooms in Tanzania, Qorro (2006) revealed that LEP teachers used incorrect English sentences and did not correct errors in student-generated sentences. Over time, teachers passed on their incorrect English to their students as they were not aware of the errors that occurred or they were unsure of what the correct forms of the sentences were. Qorro is convinced that it is “through this process of recycling of poor English into the school system that the level of English proficiency has kept on falling over the years” (p. 6). Qorro also reported that LEP teachers’ instructions in English were not clear and it could not be determined if students’ silence was due to teachers’ instructions or the students’ lack of understanding.

In Uganda, some insights into the challenges facing LEP teachers using English as the medium of instruction were offered by Kyeyune (2003). Her study investigates the teaching practices of teachers in secondary school classrooms and particularly the teachers’ use of English as a tool of classroom communication. Kyeyune reported that students struggled to learn through L2 because teachers’ explanation and questioning skills were in general “too poor for teacher talk to be effective” (p. 182). Poor teacher talk it appeared was due to teachers’ limited proficiency in the medium of instruction. Interestingly, instead of acknowledging their inadequacy in L2 use as the source of problem of student learning, teachers tended to attribute blame to students’ negative attitudes. In addition, teachers were mainly interested in the content of their subjects. Thus, students were left on their own to deal with the challenges of learning through an L2 even when teachers were aware of students’ difficulties and the possible solutions.

2.8.2 Communicative Competence

Implicit in the discussion so far is that teachers need to have communicative competence. Canale and Swain (1979, cited by Curtain & Pesola, p. 98) propose that communicative competence is the combination of competence in four areas: (1) grammatical competence, the ability to apply the rules of grammar to produce or interpret a message correctly; (2) discourse competence, the ability to connect several ideas together appropriately and to maintain an extended exchange of messages; (3) sociolinguistic competence, the ability to choose language usage according to the social situation; and (4) strategic competence, the ability to understand a basic meaning or to be understood, even when adequate vocabulary and structures are lacking.

Clearly, this taxonomy implies that teachers need to give due attention to other aspects of their discourse apart from a focus on content or meaning. This is especially critical for CBI teachers in this study since, as already discussed, engaging in scientific discourse involves using the specialized language of science. Within the classroom, they are expected to teach and model the use of this language. In addition, it is their responsibility to assist students with noticing the relationships between the forms and functions of the target language. “The integration of second language instruction with content instruction (e.g., science or history) respects the specificity of functional language use” (Genesee, 1994, p. 6).

2.8.3 Errors in L2 Use

While it is crucial for teachers to assist students in consciousness-raising (i.e. the awareness of the existence of specific linguistic features in the target language), it needs pointing out that not all teachers are adept at carrying out this task. The teachers in the present study who are deficient in English, is one such cohort. The researcher’s own

experience as a second language speaker and working with second language students has informed her that lack of resources in the target language creates difficulty in communicating ideas. When caught in such situations, falling back on communicative strategies to fill in the gap is natural. As we know, these strategies are not infallible and thus, the occurrence of errors is sometimes inevitable. It is a tragedy in education if we have teachers whose language is erroneous when they are supposed to model it correctly. Additionally, inaction to remedy the situation is irresponsible if we know there are such teachers in our classrooms. However, before we begin to discuss remedial actions, we must have the capacity to identify and describe the errors in teacher discourse.

Fortunately, Ellis (1985, 1997) has provided us with the very resource that we need. Ellis has clearly stated that error is a multi-factor phenomenon and it can be described either by using grammatical categories or in general ways in which utterances differ from the reconstructed target-language utterances. The categories which fall under the second method, he says, include:

- omission (i.e. leaving out an item that is required for an utterance to be considered grammatical)
- misinformation (i.e. using one grammatical form in place of another grammatical form)
- misordering (i.e. putting the words in an utterance in the wrong order)
- overgeneralization (e.g. the use of 'eated' in place of 'ate')
- global errors (i.e. errors which violate the overall structure of a sentence that makes processing difficult)
- sociolinguistic errors (e.g. the failure to use language in a socially appropriate manner)
- transfer errors (i.e. features of the L1 are incorrectly applied in L2 utterances)

This is useful information as we can now diagnose the errors in teachers' utterances and subsequently, measures can be taken to assist teachers to deal with the errors. In this way, it is hoped that teachers will be better models for their students. However, it does not follow that by doing this teachers will be able to eliminate errors from their speech as this researcher is fully aware that many L2 learners do not reach target language competence because of fossilization. Nevertheless, it has been shown that some errors are not resilient and can be corrected by further instruction. The point is that giving attention to errors and sharing any insights gained with teachers can act as damage control as there are errors which can be corrected easily. Moreover, discussing errors with teachers might just be the catalyst needed to encourage them to give particular attention to the linguistic aspects of their delivery in planning lessons.

2.8.4 Focus on Form in L2 Content Learning

Accuracy in forms in language use is an important issue in this study. The literature has shown a shift in how this can be achieved in the classroom. Initially, it was theorized as "the result of the development of formal rule-based knowledge, emphasizing controlled learning and rule practice as the most effective pedagogical activity" (Nassaji, 2000, p. 242). This approach which is also referred to as focus on forms is often criticized for its isolation or extraction of linguistic features from context and its lack of communicative activity. Long and Robinson (1998) question the effectiveness of focus on forms when they argue that, "People of all ages learn languages best, inside or outside a classroom, not by treating the languages as an object of study, but by experiencing them as a medium of communication" (p. 18). This belief led to the development of the communicative approach in teaching language which downplayed the importance of teaching grammar by taking away the need to focus on forms. However, this too as we now know has its weaknesses.

Lightbown and Spada's (1995) study on the effects of form-focused instruction and corrective feedback on learners' developing second language ability is telling. The study involved approximately 100 second language learners who were native speakers of French who had attended an intensive ESL course in either grade 5 or 6. Lightbown and Spada discovered marked between-class differences with regard to accuracy in the students' use of English structures such as progressive *-ing* and adjective-noun order in noun phrases. The differences, according to the researchers, were attributed to variations in teachers' form-focused instruction. It was reported that students in the class which committed the most errors were taught by a teacher who almost never focused on grammar. Lightbown and Spada, thus, concluded that "accuracy, fluency, and overall communicative skills are probably best developed through instruction that is primarily meaning-based but in which guidance is provided through timely form-focus activities and correction in context" (Lightbown & Spada, 1995, p. 323).

2.8.5 Negotiation of Meaning

The importance of giving attention to linguistic forms within activities which primarily focus on meaning has been highlighted by various scholars (Ellis et al., 2001; Lightbown & Spada, 1995; Long & Robinson, 1998; Nicholas et al., 2001). Focus on form is preferred over instruction that solely focuses on teaching or learning linguistic elements since it allows the acquisition of new linguistic forms in context. Besides, attention to form is given when participants choose to do so or when there is a need for it. Because it is occasionally done and transitory it should not break the flow of communication. Within the context of teaching content through L2 teachers are well advised to continuously engage in a negotiation of meaning process (Pica, 2002).

In negotiating meaning, both teachers and students strive to make themselves understood and to understand each other. Negotiating of meaning is particularly critical

in the current study as not only the students but the teachers also are operating through an under-developed language. Negotiating of meaning, thus, for them is a platform where they can practise the target language and progress “from a purely semantic analysis of the language to a syntactic analysis of it” (Swain, 1985, p. 252). Within this study, it is reasonable to assume that playing the leading role in negotiating meaning will not be easy given the teachers’ low English proficiency.

Met (1995) points out at least three ways in which teachers can initiate this process: making language understandable to students; helping students make their messages understood; and stretching, expanding, and refining students’ language repertoire. In order to engage in negotiating meaning, there must be interaction and comprehensible output. The following measures may encourage its production: “questioning, drawing on students’ background knowledge, using clarification and comprehension checks, paraphrasing, enriching and elaborating students’ utterances, and encouraging students to negotiate the meaning and form of their linguistic output” (Laplante, 1997, p. 69).

2.8.6 The Influence of L1 on L2 Development

As much as there is a desire for teachers and students to persevere with negotiation of meaning through L2 in CBI classrooms, it is natural and likely for them to resort to L1 especially when they share the language. This is due to the accessibility of L1. In the current study in which not only the students but also the teachers have not gained mastery of L2, the likelihood of this occurring is even greater. Thus, code-switching is an issue that warrants a mention as this habit certainly would influence the extent of L2 use in the classroom.

2.8.6.1 Code-switching

One suggestion mooted to help L2 learners acquire academic scientific language is to encourage the use of the learners' L1 in instruction. Several researchers concur that the mother tongue has an important role in the learning process of a child who has to learn in a new language (Barton, 1995; Gibbons, 1993). Perozzi and Chavez-Sanchez (1992, cited by Medina-Jerez et al., 2007) showed that the learning rate of new vocabulary was more rapid when the words were first presented in L1 to bilingual students. Brice (2001) argues for allowing code-switching to act as a bridge between L1 and L2 since communication in English can be a barrier for L2 learners. This is understandable as Murphey (1997) has pointed out that for most teachers making their content comprehensible through a second language seems to be the hardest task. Teachers have been documented to fall back on L1 when they sense that learners would not understand an upcoming utterance in L2 (Setati & Adler, 2000). Using L1 is especially valued in the early stages of learning when the child has not developed sufficient skills in the language for learning. In fact, teachers are encouraged to support their students' use of their home languages in conjunction with English. This is premised on the assumption that "during the early stages of second language acquisition, students' receptive vocabularies far outpace their productive capabilities" (Barton, 1995, p. 348). This does not mean, however, L1 should be used without restraints in the classroom, because it is important for students to practice L2.

Macaro (2001) observes that objections have been raised by proponents of L2 exclusivity who argue that "learners do not need to understand everything that is said to them by the teacher and that switching to the first language undermines the learning process" (p. 531). The study by Wong-Fillmore (1985) reinforces this idea. The study which was based on data from bilingual classrooms in the United States showed that

teachers' clear division between the use of the native language and the use of the target language resulted in significantly improved second-language acquisition.

However, Bolander (2008) has revealed that teachers are not always fully aware of their language use in the classroom. In examining the proportionate use of English and Swedish, and the circumstances in which the switches take place in Swedish secondary school classes, Bolander discovered that classroom observations did not always corroborate teachers' claims about using English as much as possible in the classroom. Bolander also found that teachers had difficulty finding a compromise between not using the target language at all and using too much of it. Clearly, the pros and cons of incorporating the use of L1 in the CBI classrooms must be carefully weighed. Failure to consider the relational amounts of L1 and L2 use risks the danger that inadequate L2 ends up being taught.

2.8.7 Teacher Questioning

It is a popular belief that teacher questions during CBI can promote language use and understanding (Chin, 2007; Wong-Fillmore, 1985). Also, research scholars have frequently asserted that questioning is part of an effective teacher's knowledge bases in scaffolding students' learning (see Ball, 1991; Brown & Hirst, 2007; Townsend & Pace, 2005). This should not be a surprise as students gain in different ways when teachers ask effective questions (Caram & Davis, 2005). Each time a question is asked the students are forced to engage themselves in their learning as they are expected to provide an answer.

Teacher questioning is a simple but powerful method for engaging students to think and develop language skills but it appears that not many teachers realize this. In 1973, Galloway and Mickelson quoting Stevens wrote that "for a sample of secondary-school

classes varying in subject level two thirds of the teachers' questions required direct recall of textbook information" (145). More than two decades later Civikly (1997) noted that observational studies of teachers' questioning styles had not changed much as there was still an over-reliance on questions for which a one-word response suffices, and for which little thinking is entailed. It is indeed unfortunate if teachers continue to pay little attention to the questions they ask as questions take up a large amount of class time (Sage, 2006). Wragg and Brown (2001) attest to this when they state that:

Every day teachers ask dozens, even hundreds of questions, thousands in a single year, over a million during a professional lifetime. Intelligent questioning is a valuable part of interactive teaching...Questions are often a central part of explanations and so lie at the very heart of teaching (ibid., p. 1)

2.8.7.1 The Reasons Why Teachers Ask Questions

Morgan and Saxton (2006) explain that questions are prevalent in teacher discourse because they are used for a range of reasons, some of which have been highlighted above. Teachers ask questions to keep students actively involved in lessons, to provide students the opportunity to express their thoughts, to enable students to hear alternative explanations of the materials by their peers, to pace their lessons and maintain discipline, to evaluate student learning, and revise their lessons. Wragg and Brown (2001) report that teacher questioning is also meant to "stimulate recall, to deepen understanding, to develop imagination and to encourage problem solving" (p. 6).

In writing about guiding learning through skillful questioning, Pate and Bremer (1967) reported a study in which 190 elementary-school teachers were asked to state three important purposes for questioning students. 129 teachers said that teachers' questions are important for the purpose of checking on what has been learned as a result of teaching. 89 teachers mentioned to check students' ability to recall specific facts. Among the more interesting findings was that others said to require the use of facts in

generalizing and in making inferences were important purposes. However, few teachers listed both purposes. Furthermore, only 16 and 2 teachers gave the answer to have students check their own learning and to discover pupils' interests, respectively. Pate and Bremer suggested that the teachers' responses might mean that they were thinking of questions that require short answers. This led them to conclude that perhaps many teachers had not considered carefully the purposes that questions may serve.

2.8.7.2 Types of Questions

Sage (2006) believes that how we frame questions is important for effective answers. We have also been informed that teachers can influence student answers in two ways. One is by the type of questions teachers originally ask the student, and the other is by the follow-up questions teachers ask subsequent to students' responses (Good & Brophy, 1973).

There have been several attempts to classify teacher questions. One of the earliest scholars to categorize questions was Bloom who classified questions according to different cognitive levels (Chin & Langsford, 2004). But classifying questions in this way is considered weak as the processes are inferential constructs that are not observed directly (Gall, 1970). Wragg and Brown (2001), suggest that the content of questions related to learning a particular subject may be classified as one of three types:

- Conceptual questions concerned with eliciting ideas, definitions and reasoning in the subject being studied.
- Empirical questions requiring answers based on facts or on experimental findings.
- Value questions investigating relative worth and merit, moral and environmental issues.

(Wragg & Brown, 2001, pp. 16-17)

Wragg and Brown also refer to questions as narrow or broad (also known as closed/open or convergent/divergent) and recall versus thought questions. Narrow questions are those that yield short answers and inhibit discussion whereas broad questions require a relatively wide-ranging set of possibilities. While recall questions test existing knowledge and observation, thought questions “use old knowledge to create new knowledge and ideas in the learner” (ibid., p. 21). Elsewhere, extensive and excellent examples of questions have been compiled and discussed by Morgan and Saxton (2006) in their book *Asking better questions*.

Besides what has been pointed out so far, there are ample documents showing that not all teacher questions are equally good. In fact, Dillon (1978) convincingly argues that instead of being effective stimulants, more often than not, teacher questions depress student thought and response. Premised on this assumption, suggestions have been made for teachers to use some types of questions more than others. For example, recall questions are often considered as cognitively low-level and so are ineffective means to stimulate student thought and participation. Naturally, teachers are routinely advised to use them sparingly or at least to follow them up with other types of questions (Davis, 1914; Good & Brophy, 1973; Wragg & Brown, 2001). In contrast, teachers are encouraged to ask problem questions to push the student to not only recall knowledge but also to rearrange it and apply it and thus making it his own. Pate and Bremer (1967) put it in this way, “If learning is seen as not only the acquiring of knowledge, but also as skill in using this knowledge, teachers need to recognize that questions offer an excellent means of checking on pupils’ skill in organizing facts and on pupils’ understanding of relationships among facts” (p. 418).

2.8.7.3 Characteristics of Good Questioning

Besides insights on purposes of teacher questioning and the types of questions teachers ask, we are also not short of advice on strategies for questioning. This information is certainly useful in assessing our questioning behaviour. According to Davis (1914) a good question has four characteristics. Firstly, it must be clear in that the language used is intelligible to the students. Secondly, the question should be terse. Thirdly, a question must keep to its point. Finally, a question should be reasonable i.e. it should be such that the children may reasonably be expected to answer. He states that wandering from the point is a very common problem with young teachers “and in the majority of the cases it is caused by unpreparedness” (p. 33). His reminder to teachers that the questions they ask during the delivery of their lesson need as much preparation as the facts of their lesson is certainly apt.

Wragg and Brown’s (2001) key tactics in questioning are also useful reference. The tactics are listed below:

- **Structuring.** This refers to providing signposts for the sequence of questions and topic.
- **Pitching and putting clearly.** These are similar to Davis’ third and fourth characteristics.
- **Directing and distributing.** These are related to the issue how many students answer questions. Wragg and Brown note that teachers are prone to direct questions to students who mostly sit in central seats although there may be many others who raise their hands. They hold that questions should be distributed around the group so as to reduce the risk of losing attention and class control. Davis’ (1914, p. 42) reminder must be noted:

Sometimes we must sacrifice the class for the individual, and sometimes the individual for the class. Although you have a class to teach, yet, it is well to remember that it is the individual mind which you have to train. This points, then, to the advantage (perhaps the necessity) of questioning, sometimes, the individual...But while doing so, care must be taken that the other members of class are listening- that they feel the questions to be directed to them also; that they, too, are profiting from the interrogation. This is difficult to attain, but it must receive attention or the majority of your class will be wasting time.

- ***Pausing and pacing.*** These attributes are associated with the amount of time teachers allow students to respond before asking someone else, answering the question themselves, or rephrasing the question. “Pauses act as signals for pace” (Wragg & Brown, 2001, p. 32).
- ***Prompting and probing.*** These are follow-up questions when the first answers are inadequate, or inappropriate. While prompts provide hints, probes require more precise or detailed answers.
- ***Listening to replies and responding.*** According to Wragg and Brown, there are four types of listening: *skim listening* (i.e. the listening done when answers seem irrelevant and when teachers want to get on with the lesson or are preoccupied), *survey listening* (the kind of listening when the teacher filters out unnecessary information and identifies the key points or misunderstandings of the pupil), *search listening* (described as active searching for specific information to an answer, or to a series of answers), and *study listening* (i.e. a subtle blend of search and survey listening, which goes beyond the words that the students use to their underlying meaning and uncertainties (p. 34).

Responding is defined as the move teachers make after a student answers or comments. Effective responding moves identified by Wragg and Brown include giving reinforcement and feedback to students. Mercer (1995) believes that teachers can sustain dialogic discussions by appropriating what students say as the basis for structuring their subsequent utterance. This naturally, allows the integration of the students’ remarks into the teaching-learning process. He suggests some practical ways to do this: *confirmation*, *repetitions* that help to draw the attention of the whole class to an answer judged to be significant, *paraphrasing or reformulating* a student’s remark which offers a corrected, tidied-up form of the student’s statement which matches better with the teacher’s point, *elaborations* that pick up on “a cryptic statement made by a pupil and expands and/or explains its significance to the rest of the class” (Mercer, 1995, p. 33). Clearly, the method of dealing with answers is just as important as the art of questioning.

- ***Sequencing questions.*** This refers to the patterns that emerge as a result of the responding moves of the teacher in between questions.

Wragg and Brown (2001) reported some interesting findings. Through their analysis of more than a thousand questions that teachers asked during classroom discussions, 53% of questions stood alone and 47% consisted of a sequence of two or more questions. Out of the 47%, only 10% were part of sequence of more than four questions.

Based on what has been discussed, it is apparent that the art of questioning is of vital importance to a teacher. There should also be recognition that preparing well to question must not be underestimated in order to avoid falling into the trap of asking superficial, ill-formed or inconsequential questions. Having said that, how LEP ETeMS teachers in this study fare in questioning through L2 given their low proficiency will be revealed through the analysis of teacher classroom discourse in Chapter 4.

2.8.8 Characteristics of Effective Teachers

It should be clear by now that the work of the teacher in the CBI classroom is challenging and complex. Fortunately, we have many suggestions, tried and tested, to show us the way forward and help us to believe that this difficult task is surmountable. The study by Wong-Fillmore (1985) is insightful. Wong-Fillmore investigated the instructional practices of teachers of LEP students and their effects on second language learning. The study which was conducted in elementary classrooms involved Cantonese and Spanish-speaking children who were described as either non-English speakers or extremely limited in English proficiency. The findings which emerged showed that there were certain characteristics of teacher talk that were effective as input. They include:

- Clear separation of languages- no alternation or mixing
- Comprehension emphasized- focus is on communication
- Language use is entirely grammatical- appropriate to activity
- Tailoring of elicitation questions to allow for different levels of participation from students
- Richness of language use, going beyond books, playfulness

(Wong-Fillmore, 1985, p. 50)

Curtain and Pesola (1994) offer the following useful pointers for teachers in the EFL classroom. Firstly, teachers must create the need to communicate, and they must take full advantage of every naturally occurring communicative situation. Secondly, they emphasize the necessity for teachers to do extensive adaptation of older materials in order to provide opportunities for communication once they have made a commitment to communication as an organizing principle. Finally, they advise teachers to surround concrete experiences with language. The assumption being the link between language and action enhances the impact of the language itself and encourages its retention in long-term memory (The reader is also referred to Section 2.5.11 for more examples).

It is reasonable thus, to assume that CBI is “doable” but first, teachers must plan and teach mindfully. Met (1995) maintains that “All good teachers must be good planners” (p. 160)” and this researcher is inclined to concur.

2.9 Conclusion

This chapter discussed the implementation phase of change which is based on the model provided by Fullan (1993a, 2001b). A case for investing in professional development in the light of the complex nature of teaching content through a second language was made. The insights gained will contribute towards the analysis and understanding of the factors that affect LEP teachers’ transition towards CBI. The knowledge bases for teaching, drawn particularly from the model proposed by Turner-Bisset (2001), were also discussed in detail. In addition, issues that need to be borne in mind when thinking about CBI were presented. A large part of this chapter also argued for the importance of teacher talk within the CBI classrooms. Insights gained from works of exponents and researchers discussed in the review of literature both informed and helped hone the research design of the study. The methodology chapter which follows will deal with the design in greater depth.

CHAPTER 3

METHODOLOGY

3.0 Introduction

Research has informed us that the success of content-based learning through English is highly dependent on the preparedness of the teacher entrusted with the task. A well prepared teacher should have in her repertoire all the teacher knowledge bases necessary for effective teaching and learning. The poor success of the ETeMS policy was attributed often to the teacher not doing a good job. Therefore, the present study, attempts to uncover the knowledge bases that teachers in one rural primary school bring into bear in their science through English lessons.

This chapter presents the theoretical framework for the study, rationale for adopting case study approach, data collection instruments and analysis methods.

3.1 Theoretical Framework Underpinning the Study

This study was informed by theories on change, the literature on CBI and studies in bilingualism as well as theories on teacher knowledge. Fullan (1993a, 2001b) provides useful ways to think about change through his discussion of teacher-related factors in implementing change (see Section 2.1.2). The literature on CBI and studies in bilingualism were useful in guiding the analysis of teacher talk. Particularly useful was Wong-Fillmore's (1985) study of discourses in primary science classrooms where most learners were LEP. The ways in which teachers can sway the learning process of their students through their talk were described earlier (see Section 2.8.8). By analyzing classroom transcripts, Wong-Fillmore (1985) gave an insightful description of ways in which successful teachers used their talk to positively influence their students' learning.

In the same study, she also highlighted features of talk by less successful teachers. The insights gained provided the researcher a broad taxonomy for analysing teacher talk in the present study. Turner-Bisset (2001) through her typologies of teacher knowledge bases provided a comprehensive framework for examining the professional knowledge that teachers brought into their teaching of science through English (see Sections 2.5.1 to 2.5.11).

Cochran-Smith and Lytle (1999) propose “that teachers who know more teach better” (p. 249) but what does it mean for teachers to know? Initially, to know was perceived as mastery of teaching skills hence, the conceptualization of teaching as an art, teaching as a craft, and teaching as competence were common (Turner-Bisset, 2001). There was also a myth that teachers only needed expertise in their disciplines in order to be effective in classroom teaching (Major & Palmer, 2006).

The focus on skills and subject matter continued until Shulman (2004) pointed out that teachers need many different kinds of knowledge which include content knowledge, pedagogical content knowledge (PCK), and curricular knowledge. Shulman perceived PCK as a second kind of content knowledge which includes:

...the most regularly taught topics in one’s subject area, the most useful forms of representation of those ideas, the most powerful analogies, illustrations, examples, explanations and demonstrations – in a word, the ways of representing and formulating the subject that make it comprehensible to others...understanding of what makes the learning of specific topics easy or difficult...teachers need knowledge of the strategies most likely to be fruitful in reorganizing the understanding of learners...knowledge about the misconceptions of students and about the instructional conditions necessary to overcome and transform those initial conceptions (Shulman, 2004, p. 203).

The construct of PCK in a way reflects the complexity of teachers’ knowledge. Other scholars (Grossman, 2005; Hiebert, Gallimore, & Stigler, 2002; Turner-Bisset, 2001) too have begun to recognize this. Writing about teacher knowledge within the context of reform, Elmore (1996) argued that how and what students learn depend on how

teachers understand knowledge and learning and how they operationalize their understandings. Peterson (1997) identified knowledge, skills, and attitudes, with a superordinate component of awareness as critical in teacher preparation for CBI. In her discussion of what constitutes expert teaching, Turner-Bisset (2001) wrote, “What can be observed about teaching can be likened to the tip of the iceberg. Under the surface of a seemingly effortless act of teaching is the other nine-tenths of the iceberg: a wealth of different kinds of knowledge on which the teacher has drawn for that particular teaching performance” (p. xii). Her model of teacher knowledge bases for teaching which provides the theoretical framework for this study is shown in Figure 3.1.

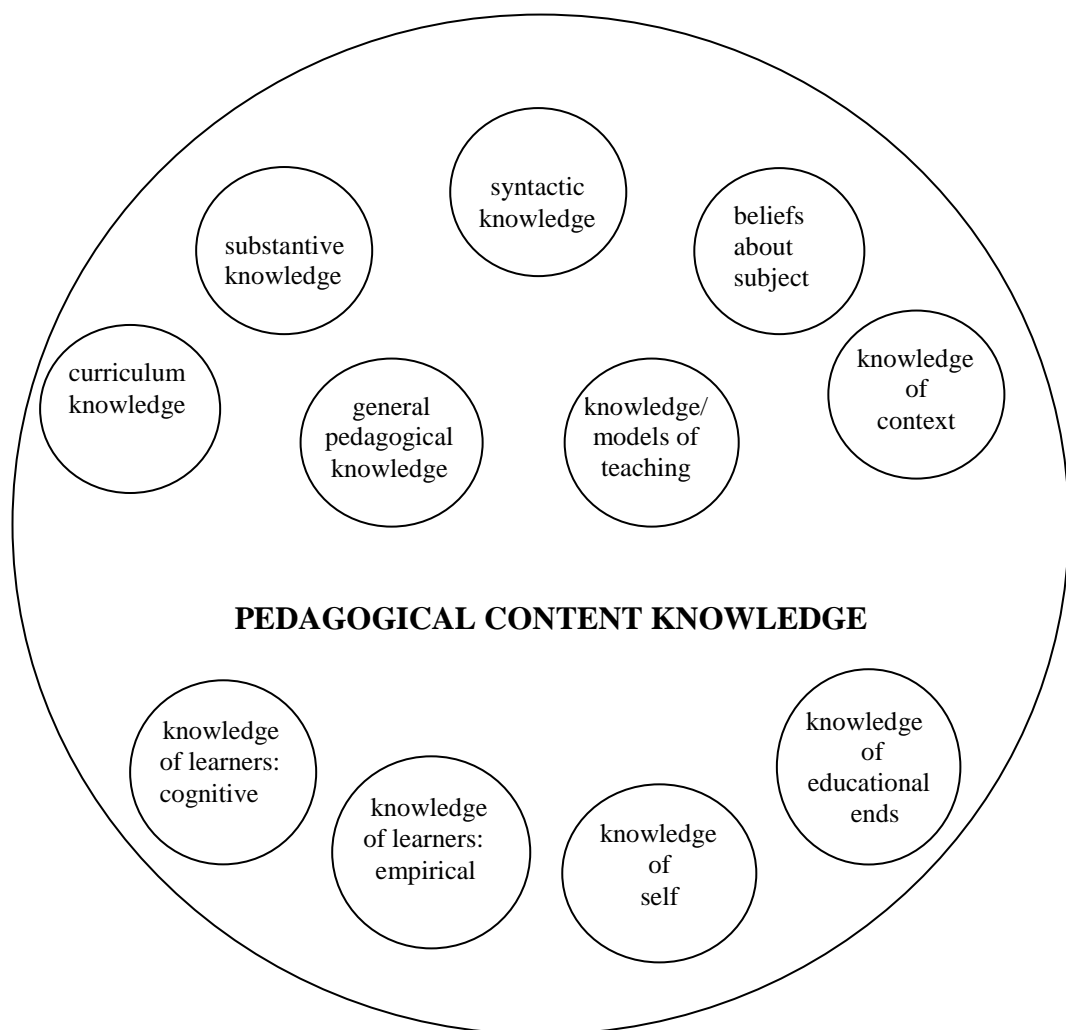


Figure 3.1: Knowledge Bases for Teaching: The Model (Turner-Bisset, 2001, p. 18)

3.2 Research Questions of the Study Revisited

It would be useful at this point to revisit the research questions of the study before proceeding to discuss the research approach and methodology. As stated earlier (see Chapter 1: Section 1.12), the study aims to examine the role of language proficiency as a significant teacher knowledge base in the teaching of science through English. To this end, the following research questions have been posed:

Research Question 1

How does the nature of teacher talk of LEP teachers impact the teaching of science through English in primary classrooms?

- a. What is the impact of language choice on the teaching of science through English in primary classrooms?
- b. Do language choice preferences in realizing pedagogic functions affect the teaching of science through English in primary classrooms?
- c. To what extent does the command of language affect the teaching of science through English in primary classrooms?
- d. How does the quality of questioning techniques affect the teaching of science through English in primary classrooms?

Research Question 2

What teacher knowledge bases did the LEP teachers have/did not have that influenced their English language use in the teaching of science through English?

The first question is answered by examining aspects of teacher talk related to language choices, the functional distribution of English and Malay language, teachers' command of English language, and the quality of questioning techniques. Language choices are investigated to determine the proportion of English language use in the classroom. Language choices related to particular pedagogic functions are studied to determine the range of functions for which English is used. Teachers' command of English language is

investigated to uncover the range of errors committed by the teachers. The quality of teacher questioning techniques is given focus to determine the quality of questions asked and the kind of learning promoted by the teachers.

The second question is answered by examining various knowledge bases that teachers brought into their lessons. Turner-Bisset's (2001) taxonomy of teacher knowledge bases provided the analytical framework for this purpose. It is necessary to study teachers' knowledge bases in order to understand their influence on teachers' classroom practice.

This study seeks to accomplish all of the above by adopting the case study approach.

3.3 Rationale for Adopting Case Study Approach

Case studies have been criticized on various aspects such as lack of systematic handling of data, lack of basis for scientific generalization, time consuming and open to interpretation (Yin, 1994; Zaidah, 2007). Despite these criticisms, the researcher has chosen this research approach for the following reasons. Firstly, a case study allows the researcher to study a phenomenon in a real world setting. As pointed out by Chih-en (n.d.), the researcher probes into events that happen in natural settings without having the need to create a controlled environment such as that in experimental research. A case study is therefore strong in reality.

Secondly, a case study can be conducted in a small scale with a view to building theory (Eisenhardt, 1989) or generalizing theories (Yin, 1994). The current study is a preliminary investigation into the role of language proficiency in the teaching of science through English in an ESL context. The study which is small in scale has no intention to generalize its findings to other populations or situations. Instead, it offers findings that could be further explored in future research involving larger sampling in similar or different contexts, from which the results could then be generalized.

Thirdly, the range of methods (e.g. audio recording, observations, interviews and questionnaires) applied in the research procedure of a case study appeals to the researcher as it allows the collection of a great amount of rich and in-depth data that would not be easily obtained through other research approaches (Yin, 1994). To explore teacher talk and the various knowledge bases of LEP teachers, it is crucial for this study to have access to thick description and details.

Finally, the researcher appreciates the time-consuming nature of a case study since it allows her to develop a close rapport with the participants. This rapport may see the participants being more honest and less inhibited. The data that are drawn from the participants' experiences can be persuasive. This helps to enhance the validity of findings.

The following section provides a description of the sampling for the study.

3.4 Sampling

Purposive sampling method was used to select the teachers and the site for this study. I heeded the advice that a qualitative researcher needs to “purposefully select participants or sites...that will best help the researcher understand the problem and the research question” (Creswell, 2003, p. 185). Teachers who participated in the study had to be below 45 years old when data were collected as I was interested in examining the talk of teachers who were predominantly Malay-educated. The teachers within the specified age range fulfilled this criterion as the majority would have had Malay as the medium of instruction both at school and the tertiary levels.

Initially, my target participants were mathematics teachers as there were more contact hours for this subject and the teacher number was also bigger. However, this had to be abandoned as five out of seven teachers decided to pull out half-way through data

collection citing a change of mind about participating in the study. The teachers admitted to feeling awkward when their lessons were observed. They expressed their intention to leave the study as they did not think they could bear the psychological stress that came with collection of data over an extended period of time. According to Ahern and Le Brocque (2005), participant attrition is a problem in case studies particularly if the studies are longitudinal. This was something I did not anticipate and hence was not prepared to deal with it.

Eventually, I decided not to focus on mathematics teachers after experiencing problems in deciphering lesson transcripts. The absence of visual recordings made it impossible for me to follow the thread of discussions in my data despite my first-hand observations. All the science and mathematics teachers I observed had requested only audio recorders to be used to protect their anonymity. I respected their wishes as ethics of research dictates that recording devices should not be used when participants refuse permission or appear uncomfortable in their presence (Yin, 1994). Consequently, only data from science teachers were used.

Although I started with five science teachers, two who were observed and recorded were later excluded from the study. One transferred to a school in another state. The other was relatively more proficient and more senior, in age and experience, to the teachers whose data I used for this study. She was 44 years old and described as an average user of English based on her Band 3 score in the compulsory English Proficiency Test for Mathematics and Science Teachers. The selection of participants was eventually made on the basis of a degree of homogeneity of their age, English language proficiency and working experience.

The other criterion used to select teachers was their willingness to participate, be observed, audio-recorded and interviewed. The study which was carried out over a few

months required close cooperation from the teachers. It was important to have teachers to commit themselves. Although I did not set out to limit my participants to one particular race or gender, the participants were all Malay and female. Table 3.1 provides some details of the participants.

Table 3.1: Details of Research Participants

	Ruhani	Farina	Zuleyka
Age	29	28	29
Malay grade	Credit 5	Distinction A2	Distinction A1
English grade: SPM Proficiency test	Credit 6 Band 2	Pass 7 Band 1	Fail 9 Band 2
Education	Dip. Ed.: 2000 Science and Living skills Attended ETeMS Part-time: B. Sc	Dip. Ed.: 2000 Science Attended ETeMS	Dip. Ed.: 2002 Science and Living skills Attended ETeMS Part-time: B. Sc
Total work experience ETeMS	8 years 4 years	8 years 4 years	6 years 3 years
Science classes Total science teaching periods	2008: Year: 2, 5 & 6 18	2008: Year: 2, 3 & 4 10	2008: Year: 1, 2, 3, 4 & 6 19
Science classes Total science teaching periods	2009: Year: 4, 5 & 6 25	2009: Year: 2, 3, 5 & 6 16	2009: Year: 2, 3 & 4 14
Other subjects Total teaching periods	2008: CV & SS 6	2008: BM, CV, LS & PE 16	2008: MZ & SS 10
Other subjects Total teaching periods	2009: MZ & SS 4	2009: AT, LS, MZ, HL & PE 11	2009: SS, PE, EN & HL 16
Other duties	Head: Science panel, Homeroom teacher, Advisor- netball, Science Club (1hr. alternate week), uniform unit (2 hrs. alternate week)	Homeroom teacher, Advisor- Science Club, Traditional games (1 hr. alternate week), Red Crescent (2 hrs. alternate week)	Homeroom teacher, Advisor-, School landscaping, Chess (1 hr. alternate week), Brownies Club (2 hrs. alternate week)
Others	Part-time student, married with 2 kids	New arrival, married with 3 kids	PIERS, Part-time student, married with 2 kids.

Subject codes: AT- Art, CV-Civics, EN-English, SS-Survival skills, MZ-Music, BM-Malay language, LS-Local studies, HL-Health, PE-Physical education. SPM-Malaysian Certificate of Education

As Table 3.1 shows, all of the main participants, Ruhani, Farina and Zuleyka (pseudonyms are used in this study to preserve anonymity), were aged between 28 and 29 at the beginning of the study. They all had a better command of Malay than English. Farina and Zuleyka obtained exceptional grades for SPM Malay (distinction). Ruhani passed with a Credit 5, an average grade. Her grade for English in the same examination was also average (Credit 6). Farina, however, managed a passing grade while Zuleyka failed the subject. All three were deemed as very poor or poor English language users based on their Bands 1 and 2 scores in the compulsory English Proficiency Test administered for ETeMS instructors. All three were certified teachers who earned a teaching diploma from local teacher training colleges. Fazilah majored in Science while Ruhani and Zuleyka majored in Science and Living Skills.

The teachers had all attended the ETeMS training conducted by the English Language Teaching Centre, Malaysia (ELTC) sometime between 2004 and 2005. During this study, Ruhani and Zuleyka were enrolled at the Open University pursuing a Bachelor of Science degree on a part-time basis. Zuleyka was also participating in a ten-month course dubbed as PIERS, a project commissioned by the royal family of Negeri Sembilan, one of the states of West Malaysia, to increase proficiency in English in rural schools in Negeri Sembilan. As a participant she had to attend a 2½-hour class held at the school, once a week after school from January to October 2008. Ruhani was excluded from the PIERS project as she was pregnant. Her due date and confinement period did not make her a viable candidate. Farina was transferred to the school months after the commencement of the project as such missed the opportunity to participate in PIERS.

The teachers were not novice in terms of working experience having chalked up between six to eight years of teaching. However, teaching science through English was a novelty. In 2008, Ruhani and Farina taught science to three different cohorts. Zuleyka, in contrast,

had to teach a wider range of students. Their total science teaching periods for that year were 18, 10 and 19 for Ruhani, Farina and Zuleyka respectively. Besides science, these teachers also taught other subjects. The total periods taught for the other subjects ranged from six to 16. While Ruhani and Zuleyka had two other non-science subjects, Farina had four. In 2009, the teaching load for science increased for Ruhani and Farina after the transfer of a colleague. Zuleyka was spared because she taught some classes in the morning and afternoon sessions when the school split into two sessions due to a major renovation. However, her teaching load for non-science subjects increased and so did the range. But the teacher who had the most variety in her time-table was Farina. Besides teaching five non-science subjects, she taught science to four cohorts.

The teachers also had other duties to perform. Like every teacher in the school, they had to put in two hours for Uniform Unit activities and one hour each for school club and sport activities after school. The former activities were alternated with the latter two on a weekly basis. All three were homeroom teachers which meant a lot of paper work and pastoral duties. As science teachers for the upper primary levels, they automatically made the pool of teachers for the extra classes (three different types, each held for 2 hours at a stretch). Above all this, Ruhani was also the Head of the Science Panel. Additionally, all three teachers were married and had young children.

The selection of the research site was made after learning that the shortage of specialist teachers in English, science and mathematics had led to poor student performance in rural Jempol district in the state of Negri Sembilan (Ismail, 2007). Although permission was sought and given to conduct the study in schools around Kuala Pilah and Jempol districts (see Appendix 1), pragmatism dictated that focus should be given to one school. Thus, a primary school in the Jempol district was chosen. Within the school,

further narrowing was done when it was agreed that teacher-student interactions would only be recorded in Year 3 to 5 classrooms.

The school was built within a self-sufficient Federal Land and Development Agency (FELDA) settlement. Demographically, all teachers, students and staff members are Malay. The surrounding community, also 100% Malay, is largely involved in agricultural activities related to oil palm and rubber. The teaching staff comprised 51 teachers, in addition to a headmistress- during the later part of the study she was replaced by a headmaster- two senior teachers and six support staff.

The student population, made up of an approximately equal number of male and female, totalled 774. The school follows a streaming system beginning from Year Four that separates the students into four achievement groups ranging from Za'ba (the high achievers) to Aminuddin Baki, Ibnu Sina, and Al-Ghazali (the low achievers). Students are imbued with deep moral and religious values. Prayers were recited at school assemblies and events, and the beginning of lessons. Students were constantly reminded to mind their manners. It was second nature for students to bow and greet the elders they meet as a show of deference. Students in some of the classes observed lined-up to thank their teachers and kiss their hand at the end of the school day.

3.5 Data Collection Instruments

Data collection for this study relied on the following instruments:

- Audio recording of lessons
- Observations
- Teacher interview
- Teacher questionnaire
- Documents

3.5.1 Audio Recording of Lessons

This was the primary instrument used to provide data to answer research question 1. The verbal data during classroom interactions and teacher interviews were recorded on a digital audio recorder and a cassette tape recorder. Audio recorders were chosen for collection of talk data to guarantee anonymity of the participants. Using recorders provided an opportunity for the participants to share directly their “reality” (Creswell, 2003). Additionally, the recorders were relatively unobtrusive. Cazden (2001) points out transcripts of recorded lessons “make possible close attention to the words of a particular classroom” (p. 7).

3.5.2 Observations

Case studies have been criticised for being open to interpretation (Mays & Pope, 1995). This implies that the findings of such studies are debateable. In order to enhance confidence in the findings of the current study, observation was included for triangulation purposes in investigating research questions 1 and 2. Observational evidence was useful in providing additional information to understand the phenomena under study (Creswell, 2003; Yin, 1994). An observation sheet to make quick notes of details such as the date, time, class, teacher, lesson topic, and student number was prepared for use during classroom observations (see Appendix 2). There was also space to record field notes such as student and teacher behaviours besides the researcher’s comments. Teachers were also observed during interactions with others at the staff room, the canteen, during PIERS sessions and after school activities with students. Field notes were also taken during these observations.

3.5.3 Teacher Interview

Teacher interview was employed to provide a more complete set of findings for research question 1. The stimulated recall interview method was used during interviews with teachers to discuss transcribed talk of classroom interactions. It provided me the opportunities to probe into matters that emerged in the transcriptions. Two copies of transcription with numbered turns for each lesson were prepared for the teachers' and my reference during the interviews. The transcriptions were necessary to assist recall in the absence of visual stimulus and due to the fact that the interviews could not be conducted immediately after recording was completed. Frequently, the interviews had to be delayed because the teachers were unable to commit themselves due to either time constraints or other reasons which rendered them inaccessible. Teacher interview was also the primary instrument used to provide data to answer research question 2. All the teachers were interviewed in school in between classes. The interviews were recorded with the teachers' consent and were conducted smoothly without being derailed by my lack of shorthand skills.

3.5.4 Teacher Questionnaire

Teacher questionnaire was the third method employed for triangulation purposes. A questionnaire which explored several themes which were deemed relevant to this study was developed by the researcher as no available questionnaire could fulfil the needs of this study. The questionnaire was developed based on readings (Lorenzo et al., 2009; van Hover & Pierce, 2006) and personal experience. The themes included were: the teachers' background, the teachers' perceptions of ETeMS, teaching science through English, language related issues, supplementary materials, and other teacher-related issues (see Appendix 3).

3.5.4.1 Teacher Background

This section comprised 18 items eliciting teachers' age, English and Malay grades for SPM, educational background and qualifications, teaching experience, English language-related professional development received and teachers' perceptions of the usefulness of training received. Information regarding the teachers' language background was important since a strong language foundation was required to deliver lessons which aligned with ETeMS policy. In explaining why it is crucial for teachers to know more about language, Wong-Fillmore and Snow (2000) argued that effective teaching involves communication with students. Communicating successfully, according to them, demands that teachers have the competency to construct their language output for maximum clarity. In addition, teachers are expected to have strategies for understanding what students are saying.

The English language-related training that the teachers received prior to this study was elicited to provide a basis to gauge the amount of English language exposure the teachers had received and the possible impact it had on instruction. In addition, they offered insights into the courses attended. All these were valuable information to indicate if teachers had sufficient professional preparation to face challenges posed by ETeMS. The teachers were required to disclose courses they had attended, the duration of the courses, the number of hours of training, the skills taught as well as to indicate whether or not the courses were useful and why.

The teachers were asked to state their training and qualification to gauge the level of tertiary education they had and the suitability of their qualifications for the teaching of science. One item elicited teachers' specialist area to determine if the teachers were teaching within their area of expertise. It was reported that there were teachers teaching subjects outside their area of expertise as a result of teacher shortage in some schools

(Anonymous, 2006). Also, there are teachers who are in the profession because they were unable to find employment elsewhere (“Paksa Rela,” 2008).

The last aspect covered in this section was teaching experience. Teachers were asked when they became qualified teachers and in what year they started teaching science through English. These questions stemmed from previous studies which found that experienced teachers differ from novice teachers in the way they structure and manage their lessons (Leinhardt, 1986; Viiri & Saari, 2006).

3.5.4.2 Teacher Perceptions of ETeMS

This section comprised 16 items which explored the teacher’s feelings about the policy, their knowledge about the policy, their perceptions of their own ability to teach science through English and their beliefs about their students’ ability to achieve the objectives of the policy. These themes were included to see how they shaped the teachers’ teaching practices. Teachers’ beliefs and perceptions have been shown to directly influence what teachers do in the classroom (Weiss, 2004).

3.5.4.3 Teaching Science through English

It was important to know what went on in the classroom as a result of implementing the policy especially since the policy was decided centrally. The teachers had no control over the policy decisions but they certainly had full control over how the policy was implemented in their classrooms. How the policy was implemented was largely determined by the decisions they made. Bearing this in mind three questions were asked with regard to teaching approach to find out if adjustments were made to the approach used when instruction was in Malay. The teachers were asked to reveal the kinds of adjustments made, if any, or to explain the reasons for the lack of them.

Another theme covered in this section was instructional problems with four items focusing on the problems the teachers faced teaching science through English. The teachers were required to describe the problems and their contributing factors as well as the steps taken to solve the problems. These were useful insights to understand the daily problems teachers faced and the extent to which teachers were aware of the coping strategies they used to deal with the problems.

Lesson planning was explored as its influence on instruction cannot be underestimated. The teachers were requested to disclose the amount of time spent on preparations, the aspects emphasized and how teaching preparations were done. Having access to this information provided another means to interpret the teachers' instructional practice. Civikly (1997) proposed a Five-Plan method giving importance to organizational plan, motivational plan, interactional plan, props plan and timing plan in preparations prior to instruction. In a study on teacher talk patterns in science lessons Viiri and Saari (2006) recommended that student teachers plan the talk types to be used in the different sections of their lesson with their tutor teacher. They argued this helps to impress on the student teachers that besides good content knowledge, teachers also must master different methods of interacting with their students.

3.5.4.4 Language Related Issues

This section focused on teachers' and students' language use, and teachers' perceptions of the textbook language and its level of difficulty. Teachers were asked how much Malay they used in instruction and the purposes for which it was used. The items on language use were included to see if teachers were aware of their language behaviour as this awareness has a bearing on students' exposure to English. Teachers were asked how their students coped with ETeMS and on whether the English used in textbooks matched their students' English proficiency. The response to these items was useful in

determining if the teachers knew their students' language behaviour, language problems and how their students dealt with the problems. Questions about textbook language were also raised to discover the teachers' opinions about it because their opinions could influence their instructional decisions and actions.

3.5.4.5 Supplementary Materials

A section on supplementary materials was included to find out if teachers utilized other materials besides the prescribed textbooks. The teachers were asked to identify the purposes for using supplementary materials to gain insights into the motivations for using them. A question was asked about preparing separate materials for students of different abilities. This helped to determine if there was variety in the materials used in the science classroom to cater for different student needs. To see if teachers were resourceful one question in this section asked for the sources of their preferred supplementary materials. Also asked was the rationale for their preference to determine if there were language-related issues involved in choosing one source over another. The teachers were also asked if they created their own materials and to explain the reasons for not doing so. This was an indirect way of learning about teacher's ability to utilize their English language creatively in their instruction.

3.5.4.6 Teacher Related Issues

The main objectives of this section were to investigate teachers' perceptions of their language use in terms of their pedagogic functions. For example, teachers were requested to indicate the language used for teaching acts such as checking comprehension, explaining tasks, or asking question.

3.5.5 Documents

Besides the instruments already mentioned, another source of data for the purpose of triangulation employed in this study was the collection of personal and school documents. These included teaching schedules, letters, test papers and handouts. These artefacts provided an unobtrusive source of information which was accessible at any time convenient to the researcher.

3.6 Data Collection Procedures

Foster (1996) states that it is imperative for the researcher to seek formal permission from subjects and those responsible for them in order to observe in the setting where observational research is conducted openly. Prior to commencing the study, clearance was sought from the MOE and the Negeri Sembilan State Education Department. Upon their approvals (see Appendix 1), I visited the headmistress to express my intention to conduct my research at the school. This was on 1 April 2008. On the same day, I was introduced to the science and mathematics Panel Heads. I briefed them about my research and requested their assistance to alert potential participants and of my wish to meet them. A meeting with all the teachers was not arranged due to differences in time-tables and work commitments both during and after school hours. Instead, the Senior Teacher provided me with time-tables to aid identification of my target teachers and to plan my individual meeting with them.

I returned to the school on the following day and started my meetings with different teachers, mostly teaching Year 4 and 5 mathematics or Year 5 science. This went on for four days in between classroom observations. Teachers' consent was sought during my first meeting with them to permit me to conduct research in their classrooms. They were briefed orally about my research needs and its implications on them. Upon their

agreement, teachers were required to sign a consent form (see Appendix 4). Schedules for recordings were not pre-arranged as I wanted to ensure recorded data resembled teachers' natural behaviour. Only science and mathematics lessons from Year Three to Five classrooms were recorded as I assumed that students in these cohorts were used to learning science and mathematics through English and therefore, would be able to interact with their teachers. Classroom observations and audio recordings continued throughout April and May with breaks for monthly tests or public holidays.

I recorded classroom interactions by placing the digital recorder on one of the student tables in the middle of the classroom. As a precautionary measure, a cassette recorder was placed near me to facilitate speedy changing of tapes as the need arose. I decided on a back-up recorder after data collection was obstructed in two lessons when students tampered with my recorder. Data were lost on another occasion when the batteries went flat.

Lessons were recorded from my first entry into each classroom although only talk data from the second visits onwards were considered for analysis. The first visits were meant to accustom the teachers and students to my presence in the classroom so as to minimize the Hawthorne effect. In addition, they allowed me a chance to test my recording instruments and learn how best to collect talk data as a lone researcher. Unlike other studies where recording was done every few minutes, recording in this study was continuous from the beginning of each lesson until class was dismissed. This holistic approach gave a more accurate picture of the teachers' language use.

During classroom observations, I made field notes of details which were not captured by the recorders. These details helped me to remember the classroom contexts from which data were collected. The notes from these observations were very useful in contextualizing the meaning of what was shared between the speakers. In this way they

contributed to better understanding of the lessons and greater accuracy in transcriptions. The observation notes were also useful in preparing questions for the teacher interview questions and discussions of observed lessons. Besides field notes, teaching materials used were also collected. Although I started off as observer, it was impossible to remain a detached, non-participant. As the teachers and students became more familiar with me, I was often consulted during lessons and gradually became a participant observer.

During this period, lessons were also transcribed using the digital voice editor software which has a speed adjustment facility allowing the manipulation of talk pace. Its auto backspace enabled the replay of the last few seconds of talk for checking purposes. Its counter was useful when breaks were taken during the transcribing process. As noted by Freeman (1996) background noise was distracting and made voices inaudible. The V-Up feature helped to deal with ambient noise and using headphones improved listening ability greatly. Initially, transcribing was done by me but later, help was enlisted to transcribe rough drafts as transcribing was very time-consuming. Transcribing was done in two main stages. Stage 1 focused on documenting the words uttered by teachers and students. The recorded lessons were listened to several times. Notes made during observations were referred to for accuracy. Stage 2 required replaying of the recorded lessons to mark out pauses and their duration on the first drafts. Boulton and Hammersley (1996) state: "How detailed a transcription needs to be, and what does and does not need to be included...are matters of judgement that depend on the purposes of the research" (p. 286).

Analysis commenced after a few good drafts of mathematics lessons were ready. That was when I realized it was difficult to understand the talk as teachers made many asides using abstract mathematical concepts frequently involving numbers with more than

four digits. During the observations, my poor shorthand prevented me from completely documenting the teachers' referencing sequences.

I returned to the school to focus data collection on science lessons. This was between August to September 2008. Data collection was slow because science subjects had lesser teaching periods than mathematics (three periods for Year 3; five periods for Year 4 and 5). Overlaps in time-table and postponement of classes due to teachers' medical leave, festivities in the school or last minute cancellations on teachers' requests further frustrated data collection. The school's decision to end instruction three weeks earlier also affected the process.

I resumed data collection for classroom interactions from April to May 2009. This was suggested by the teachers as the school, according to them, was more settled by then. In all, 27 science lessons were recorded and 16 were contributed by the three main research participants. They were either single periods of 35 minutes or double. Three lessons containing the most amount of talk from each teacher were selected and transcribed for analysis.

Five out of the nine lessons used in this study were transcribed by me while four were done by a hired assistant. The four transcriptions were checked and fine-tuned by listening to the recordings again. Details of the transcribing convention used are found in Appendix 5. The transcribed data contained many instances of code-switching, hence, translation was necessary for portions incorporated into this thesis. A colleague assisted me with this process, so my role was only to check the translated documents for accuracy.

Teacher interviews were conducted next to discuss pertinent details identified within the transcripts. For example, teachers were asked why translations were made or why

code-switching was done. Although informal discussions of recorded lessons were done following observations when time permitted, stimulated interviews were delayed for up to three to four weeks. This was partly because transcription was time-consuming and teachers were not always available to talk. This certainly contributed to the limitations of this study as teachers were sometimes unable to explain some incidents I brought to their attention. All interviews were conducted in Malay as requested by teachers and transcribed for analysis. Relevant portions were translated by a colleague and vetted by the researcher.

Teacher interviews based on the questionnaire were conducted at the end of the observation period. Besides the main research participants, two other mathematics teachers (Azrina and Joni) and two science teachers (Ayesha and Salmiah) who did not participate in the observation part of this study were interviewed to gain a clearer picture of teachers' experiences as CBI instructors. Teachers were interviewed individually at the staff room during their free time. Conducting the interviews in such a way was time consuming but it led to a deeper understanding of the teachers' beliefs, practice and experience. The interviews also provided room to follow-up on relevant insights raised by the teachers as they occurred. This gave the response depth as the teachers were encouraged to say more. All interviews were recorded, transcribed and portions which were incorporated into this thesis were translated (see Appendix 6 for transcripts of teacher interview extracts in Malay). Besides talking to teachers, the opinions of the headmistress and the English Panel Head were also sought through informal conversations with them.

3.7 Data Analysis Framework

The study primarily employed qualitative methods to achieve its aims. The use of qualitative methods enables the researcher to obtain a rounded picture of the subject

under study “with emphasis on portraying the everyday experiences of individuals by observing and interviewing them and relevant others” (Fraenkel & Wallen, 1990 cited by Creswell, 2003, p. 200). Qualitative methods were deemed appropriate to understand and examine the types of teacher knowledge that influenced teachers’ practice in the science through English classroom. The qualitative method also allows the researcher to go beyond categorizing features of teacher discourse as it is able to capture the dynamics of talk.

Although a qualitative study enables the researcher to capture a level of detail about the participants and the research site, there are weaknesses that must be acknowledged. Qualitative research as pointed out by Creswell (2003) is fundamentally interpretive, requiring the researcher to make an interpretation of the data. Bias may occur as personal opinion and judgments are inevitable in data analysis. Thus, it is necessary to employ multiple methods of data collection to address this issue and to build credibility of the collected data. The present study used audio recording, classroom observation, teacher interview, teacher questionnaire as well as documents.

The quantitative method in the form of frequency counts of language choice, pedagogic functions, errors in teacher discourse, aspects of teacher questions (opinion/factual questions and response required), and aspects of student response (word length and manner of response) were also included. The quantitative data were instrumental in supporting the qualitative data where necessary.

A framework was designed for the analysis of teachers’ professional knowledge and the characteristics of their talk. The components of the data analysis framework in relation to the research questions are reflected in Table 3.2.

Table 3.2: Analytical Framework for This Study

Focus	Category	Definition
<p>Language choice (Labels from Duff & Polio, 1990. Labels have been redefined to reflect the data in the current study)</p>	<p>L1 L1c Mix L2 L2c</p>	<p>The utterance is completely in Malay The utterance is in Malay with one or two constituents in English The utterance is, approximately, an equal mixture of Malay and English The utterance is completely in English The utterance is in English with one word or two constituents in Malay (see Section 4.1 for examples)</p>
<p>Teaching acts relating to language choice (Drawn from among others Fennema-Bloom, 2008; Kim, 2001; Kim & Elder, 2005; Sinclair & Brazil, 1982)</p>	<p>Definitions of sub-categories of teaching acts and their examples are provided in Section 4.4.</p>	
<p>Error analysis (Adapted from Chun et al., 1982. <i>Pronunciation errors</i> was added to the original framework following high occurrence of this error in the data)</p>	<p>Factual errors Discourse errors Word choice Syntactic errors Pronunciation errors Omission</p>	<p>Errors concerning the facts or truth value of an utterance Vague or inappropriate utterance causing difficulty for students to respond Incorrect choice or addition of parts of speech and all types of function words Errors of syntax involving tense, agreement, morphology, and word order Mispronunciations that result from teachers' interlanguage Omission of any parts of speech required by rules of standard English grammar (see Sections 4.8.1 to 4.8.6 for examples)</p>
<p>Teacher questions</p>		
<p>Functions of questions (Drawn from Kim & Elder, 2005; Fennema-Bloom, 2008)</p>	<p>Display question Genuine question Request for English Request for Malay Truncation</p>	<p>Definitions and examples are provided in Section 4.4.</p>
<p>Opinion/Factual dimension (Adapted from Good & Brophy, 2000. Categories have been redefined)</p>	<p>Opinion Factual</p>	<p>Questions seeking opinion Questions seeking factual response (see Section 4.10 for examples)</p>
<p>Type of response required (Adapted from Good & Brophy, 2000. Categories have been redefined)</p>	<p>Thought question Fact question Choice question</p>	<p>Students must provide reason or explain Students must recall fact(s) Requires only a Yes/No or either-or response (see Section 4.10 for examples)</p>

Student response: Word length (Drawn from Pontefract & Hardman, 2005)	1 word 2-3 words 4 words or more	Students provide one-word answers Students provide two- or three-word answers Student response that involves four or more words
Manner of response (Drawn from Pontefract & Hardman, 2005)	Individual Choral few Choral many	Response by one student Response by two to three students Response by four or more students
Question formations (Emerged from the data)	Truncation Wh-question Elliptical question Compound question	Statements which are shortened by removing a constituent at the end Information seeking questions realized by wh-words Questions with omitted components but can still be understood Fusion of two questions e.g. Which ice-cream would you like, chocolate, vanilla or strawberry?
Teacher knowledge (<i>Language proficiency</i> was added to Turner-Bisset's , 2001 model)	Knowledge bases	Definitions of components of teacher knowledge are provided in Sections 2.5.1 to 2.5.11.

3.8 Quantitative Data Analysis of Classroom Discourse

Three transcribed lessons from each participant were segmented into units of analysis for coding purposes. The units of analysis for the quantitative aspect of this study were *move* and *act*. The moves were in the form of the IRF turn (Initiate-Response-Follow-up) while acts were the various component functions within the moves (Sinclair & Brazil, 1982). Sinclair and Brazil state that a move may comprise one act or more. An act is defined according to how it relates to another act in the discourse rather than the function it performs on its own. Additionally, an act does not have to be a complete statement. To facilitate coding, each unit uttered by teachers within the transcript was separated by an upright slash and typed on a separate line.

Coding was done twice to attain reliability. Although I was aware of the importance of inter-coder reliability, coding was done by me on both occasions due to limited time and funding. However, I did consult a colleague from the English language department for units I found problematic. This perhaps is another limitation of this study as some of

the units were highly inferential. The second coding was done with a time lapse of three weeks after the first coding. Data management and analysis was performed using NVivo 8 software.

3.8.1 Data Analysis of Teachers' Language Choice

The analytical framework of language choice proposed by Duff and Polio (1990) was adapted to code data to describe the first aspect of the nature of teacher talk i.e. language choice. The framework was adapted by redefining the labels for categories L1, L1c, Mix and L2c. Each unit in the teacher discourse was coded under one of the following categories:

- L1** The utterance is completely in Malay
- L1c** The utterance is in Malay with one or two constituents in English
- Mix** The utterance is, approximately, an equal mixture of Malay and English
- L2** The utterance is completely in English
- L2c** The utterance is in English with one word or two constituents in Malay

In coding for language choice, English contractions such as *don't* and *can't*, and Malay particles like *lah* and *kan* were counted as one word. Words like *spring* and *battery* which are loanwords in Malay were considered as either an L1 or L2 component depending on the more dominant language within each discourse unit. Coding for all quantitative analysis in this study was done using NVivo 8 software. However, before this process commenced, coding was first done on hard copies as I found it easier to process information.

For coding using NVivo, transcribed lessons were divided into three NVivo projects. Each project represented one teacher. Within a project, three transcribed lessons from one teacher were placed under *Sources*. Coding categories were set up using the feature called *Tree Nodes*. For example, to code teachers' language choice, *language choice* was set up as the parent node while the five categories described above became

the child nodes. The setting up completed, each teacher discourse unit from the moment a lesson started to its end was highlighted and coded as one of the child nodes. Upon completion, the *Queries* feature was used to generate a table which provided details of language choices and their frequencies in each lesson. Each table generated was next transported to Microsoft Excel to enable the combination of the three small projects into one table. Each node was calculated for its frequency. The steps described here applied to all the quantitative analyses in this study.

3.8.2 Data Analysis of L1/L2 Use and Pedagogic Functions

To enable the data analysis for this part of the study, the discourse acts were coded using categories which were drawn from the literature (Fennema-Bloom, 2008; Kim, 2001; Kim & Elder, 2005; Sinclair & Brazil, 1982 among others) or which emerged from the data. Descriptions of the codes and their examples are provided in Section 4.4.

For coding using Nvivo, the label *pedagogic function* was set-up as the parent node. Under this node, the various teaching acts became the child nodes. A unit was highlighted and coded as one of the teaching acts under the parent node. Once coding was completed, a query was performed to produce a table which summarized the frequency of teaching acts in relation to teachers' language choices.

3.8.3 Data Analysis of Teachers' Command of L2

Studying teachers' command of L2 is connected directly to the topic of error analysis, an old area of research in linguistics and second language acquisition. Much of the studies in this area was conducted in its heyday which was between 1970s and 80s (Richards, 1973). As such, most of the frameworks used to study errors also came from this period. This study adapted a framework by Chun et al. (1982) which has five categories (discourse errors, factual errors, errors in word choice, syntactic errors, and

omissions) for coding errors contained in the teachers' L2 talk units. In addition to the categories used by these scholars, a category labelled as *pronunciation errors* was included in this study. Definitions of these errors are indicated in Table 3.2 (see Section 3.7) and examples are available in Sections 4.8.1 to 4.8.6.

For coding using NVivo, the six categories were set up as the parent nodes. Errors under categories like *word choice*, *syntactic errors* and *omissions* were further divided into their sub-categories (child nodes). To code errors, all L2 units within the lessons were checked for accuracy. When an error was identified the location of the error within the unit was highlighted and coded according to the category it belonged to. A summary of errors for each lesson was generated using the query facility in the software.

3.8.4 Data Analysis of Teacher Questioning Techniques

Teacher questioning techniques were given special focus in examining the nature of teacher talk because it plays an important role in determining the quality of inquiry promoted by teachers. This decision does not in any way negate the importance of the other teaching acts in the data. The inquiry approach was recommended by the MOE to promote language use. Teacher questioning techniques were coded in terms of their pedagogic functions, opinion/factual dimensions, and the types of response they required. The categories proposed by Kim and Elder (2005), and Fennema-Bloom (2008) were adapted to examine the functions of teachers' questions. Frameworks by Good and Brophy (2000) were adapted to analyse the latter two. Adaptations were made through modifications to either the labels for the categories or definitions provided in the original frameworks. Pupil responses were also examined following the study by Pontefract and Hardman (2005) to gain an insight into the balance between teacher-pupil talk, and to examine the opportunities given to them to experiment with

language. The aspects analyzed and their descriptions are indicated in Table 3.2 (see Section 3.7). NVivo was again used to code data and to provide a summary of findings pertaining to the various characteristics of questions.

3.9 Qualitative Data Analysis Procedures

The following describes the procedures involved in the qualitative analysis of teachers' talk and teacher knowledge bases for this study.

3.9.1 Qualitative Analysis of Teacher Talk

For qualitative analysis of different aspects of teacher talk, I returned to each child node in NVivo after completion of quantitative analyses. A list of talk units within each child node examined was generated by left-clicking on the node to look for emerging patterns for qualitative analysis. Apart from *act* and *move*, *exchange* was also included as the unit of analysis for the qualitative aspect of the study. An exchange, according to Sinclair and Brazil (1982), is the primary unit of language interaction and has a structure made up of IRF. However, they also stated that not all exchanges have all three elements present. In order to examine an exchange, the *Open Referenced Source* feature in NVivo was used to analyze a move or an act in its context.

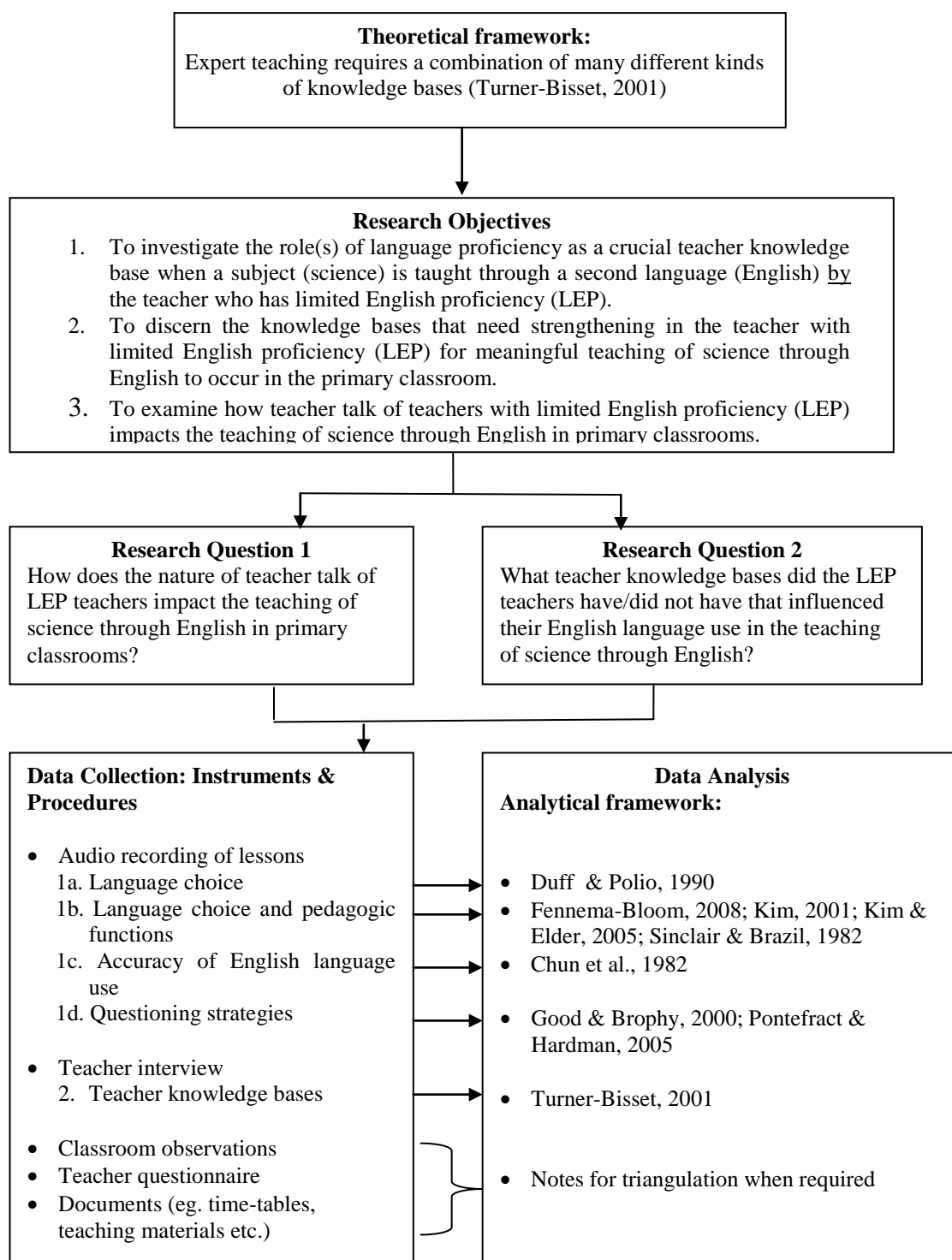
3.9.2 Analysis of Teacher Knowledge Bases

The first step in data analysis after transcribing interviews and lesson transcripts was doing a close reading of data for the purpose of identifying themes i.e. the units of analysis for the qualitative part of this study, which were relevant to the research focus (Boulton & Hammersley, 1996). NVivo 8 software was again used to manage this process. Transcribed data were first transported into *Sources*. While reading through the transcripts, data were coded according to themes which were related to the

categories of teacher knowledge (parent nodes) as they emerged. The coded data for each category of knowledge base were further sorted into sub-categories (child nodes). As such the coding categories were not pre-determined but rather developed as the reading progressed. Upon completion of the reading process, data for the various themes had already been sorted and available for use as evidence to support claims made in this study.

Figure 3.2 provides a diagrammatic representation of the methodology employed for the study.

Figure 3.2: A diagrammatic representation of the methodology employed for the study



3.10 Limitations of the Study

This study focuses on the teaching of science through English by LEP primary teachers.

It is a study within the context of a national change in educational policy which

mandates the implementation of a particular teaching approach with its pedagogical requirements. As such the researcher does not claim that the study is an implementation study. On the contrary, it should be viewed as one which examines the teacher talk of LEP teachers and their knowledge bases in teaching science through English within the context of change.

There are some limitations relating to the research design of this study that need to be acknowledged. As pointed out in Section 3.2, the data for this study was collected through the purposive sampling procedure. The first caveat that needs to be noted regarding the present study is its small sample size. Out of 27 science lessons recorded, 16 were contributed by the three main research participants. Finally, three lessons, each containing the most amount of teacher talk, taught by each participant were selected and transcribed for analysis. The final sample comprised nine lessons taught by three LEP teachers from the same school. The researcher chose to keep the sample small as she felt she would be better able to achieve greater depth. Opting for breadth would not have made this possible. The findings derived from such a small sample, some might argue, might not be transferable to other populations.

Another limitation relates to the decision to audio record teacher talk. This certainly reduced the richness of data for analysis as the audio recording did not allow for the analysis of body language to be included in this study.

The study is further limited in that factors related to time-consuming transcribing process and teacher availability sometimes resulted in delays in conducting teacher interviews. The delayed interviews meant that teachers were sometimes unable to explain certain incidents during instruction.

The final limitation is that some of the units in the qualitative method used to analyze discourse data were highly inferential and subjective. Therefore, the coding which was done solely by the researcher needs to be validated.

CHAPTER 4

DATA ANALYSIS AND FINDINGS: LEP TEACHER TALK

4.0 Introduction

In 2003, Malaysia implemented ETeMS as an initiative to provide an additional avenue for students to develop their English language skills. However, the ETeMS policy was repealed six years after its implementation. One of the problems which was often highlighted in rationalizing the repeal was that the teachers, particularly in the rural areas, were unable to successfully implement it due to their limited knowledge base in English. This study investigates how the limited English proficiency of the teachers influences the English language environment of the students during their science lessons. The features of LEP teacher talk revealed will show how a limited knowledge base in the target language makes for a poor delivery of science through English. The questions posed in this study are shown below:

How does the nature of teacher talk of LEP teachers impact the teaching of science through English in primary classrooms?

- a. What is the impact of language choice on the teaching of science through English in primary classrooms?
- b. Do language choice preferences in realizing pedagogic functions affect the teaching of science through English in primary classrooms?
- c. To what extent does the command of language affect the teaching of science through English in primary classrooms?
- d. How does the quality of questioning techniques affect the teaching of science through English in primary classrooms?

The study by Wong-Fillmore (1985) which highlighted the characteristics of teacher talk that work as input provides the general framework for analysis (see Section 2.8.8).

She discovered that effective teacher talk had certain features which could contribute towards the simultaneous development of language and content. Data for the analysis were from nine lessons taught by three teachers.

The chapter will be organized following the order of the following main themes: teachers' language choices, teachers' language choices and their pedagogic functions, teachers' command of English, and teacher questioning techniques.

4.1 Data Analysis of Teachers' Language Choices

Malay (L1), English (L2) and Mixed Codes (L1c, Mix, L2c) in the LEP Teachers' Classroom Talk

The analytical framework by Duff and Polio (1990) consisting of five categories was adapted to examine the teachers' L1 and L2 use due to the frequent language alternation in the teachers' discourse. Each talk unit by the teachers was coded as one of the following:

- L1** The utterance is completely in Malay
- L1c** The utterance is in Malay with one or two constituents in English
- Mix** The utterance is, approximately, an equal mixture of Malay and English
- L2** The utterance is completely in English
- L2c** The utterance is in English with one word or two constituents in Malay

While L1 and L2 are readily understood, the other three categories may not be as clear cut. Thus, the examples below are provided to clarify the meaning of L1c, Mix and L2c. In the examples, all L1 components are typed in bold. Translations are provided below all units containing L1 components. This format applies throughout this chapter.

- L1c** |**tulis** base **tu** **duluuu** **mana** haa|
Write where the base is first haa.

The above only contains one constituent of English and so is coded as L1c. The next example is also coded as L1c since it is mostly Malay with only one embedded noun and one noun phrase in English.

L1c |lepas ni teacher nak ajar kamu tentang controlling variable|
After this, teacher wants to teach you about controlling variable.

Mix is exemplified as follows:

Mix |attract tarik|
Attract (means) pull.

While the example above clearly shows a balanced amount of L1 and L2, the following does not. The first example is coded as Mix because it is regarded as consisting of one pronoun and one determiner in L1 combined with one noun phrase and one noun in L2. In the second example, the repeated phrase *can I* is counted just once. This makes the item more balanced in terms of the amount of L1 and L2 used and so qualifies the item as Mix.

Mix |yang number four tu window|
That number four, that one (is) window.

|can I tu apa? can I ? haa? |
'Can I' what does that mean? 'Can I'? haa?

The following are units that are coded as L2c by virtue of its content being more L2 dominant.

L2c |i go {to page} to section b ok question 8 ok ujian|
I go {to page} to section b ok question 8 ok test.

|example ya kalau teacher ukur blackboard example look here|
(For) example ya if teacher measures blackboard (for) example look here.

4.2 Findings on Teachers' Language Choices

The results obtained with regard to teachers' language choices are presented in Table 4.1.

Table 4.1: Summary of Teachers' Language Choices Tallied for Three Lessons in Five Categories

Teacher Language	Ruhani		Farina		Zuleyka	
	Total	%	Total	%	Total	%
L1	337	40.2	505	40.2	363	26.5
L1c	75	9.0	164	13.1	151	11.0
L2	362	43.2	501	40.0	735	53.6
L2c	26	3.1	24	1.9	40	2.9
Mix	38	4.5	60	4.8	83	6.0
Total	838	100	1254	100	1372	100

The table shows that the amount of L1 and L2 use varied between teachers. Ruhani's total percentage of L2 use was about 3% higher than her percentage of L1 use. Zuleyka who also had more L2 units than L1 recorded a more marked difference (approximately 27%) in the total percentage between the two categories. Farina was the only one who had a lower L2 total percentage than L1 but the difference was minimal (0.2%). These findings are surprising as they suggest that despite the teachers' low English proficiency, their L2 use was still relatively high. Further analysis was done by comparing the combined percentage of L1 and L1c with that of L2 and L2c and treating them as L1 and L2 respectively to see if the same patterns would be obtained. A different reading became apparent (see Table 4.2).

Table 4.2: Summary of Teachers' Language Choices Tallied for Three Lessons in Three Categories

Teacher Language	Ruhani		Farina		Zuleyka	
	Total	%	Total	%	Total	%
L1 + L1c	412	49.2	669	53.3	514	37.5
L2 + L2c	388	46.3	525	41.9	775	56.5
Mix	38	4.5	60	4.8	83	6.0
Total	838	100	1254	100	1372	100

Only Zuleyka remained a high L2 user. Despite remaining strong in L2 use the drop (19%) in the difference between the combined total of L2 and L1 dominant categories must be noted. This suggests that Zuleyka had used more L1 than that shown by just comparing L1 and L2 categories alone. Combining the categories also widened the difference (11.4%) in Farina's L1 and L2 total percentage. This is not surprising as Farina had admitted facing difficulties teaching science through English because of her limited proficiency (see Section 5.2: Extract 5.2T). The higher L1 counts in Ruhani's talk after comparing the combined total of L1 and L1c with L2 and L2c is expected. However, the marginal difference (2.9%) is rather surprising. Observations showed that Ruhani had great difficulties teaching through English and she too admitted feeling burdened by it (see Extract 5.3T).

Analysis of discourse units with L1 or L2 insertions revealed that all the teachers appeared to use L2c the least. L1c, in contrast, recorded the highest frequency. The findings reported here are similar to that observed by other researchers (Kim & Elder, 2005). Examination of the L1c utterances revealed the insertions were mostly single words (Ruhani: 50, Farina: 121, Zuleyka: 122) and the syntax of the utterances was based on L1 grammar. This is understandable as the teachers were more proficient in L1 than in L2. It would have been expedient for them to generate L1c type utterances since they were practically L1 in nature. Another striking feature of L1c is that 286 instances of insertion, either as single word or phrasal insertion, involved nouns. A single noun which appeared most frequently within the data was related to the teachers' habit of referring to themselves as *teacher* (88 counts) which is a cultural transfer of Malay politeness feature. This could be taken as evidence that the teachers were not only transferring their L1 grammar per se but also their L1 habit. When not attributed to habit, inserted nouns were mostly related to the teaching and learning of science. Below are some examples extracted from the data.

Single Word Nouns

straw	cubit	switch	ruler	mirror	table	base	material
leaf	wire	battery	light	beaker	purpose	space	measurement
stone	silt	bulb	metal	towel	chart	length	earthworm
liquid	iron	rectangle	pattern	marble	circuit	width	transformation

Noun Phrases

plastic sheet	the length of the spring	opaque object
garden soil	absorbent materials	transformation energy
responding variable	the number of marbles	transparent material
layers of soil	symbol and wire	sandy soil

These noun components often functioned to complete the meaning of the L1c utterances. The following examples illustrate how this was done:

Extract 4.1

1. |ok class silt **dalam bahasa Melayu apa?**|
Ok class, what is X in Malay?
2. |liquid **tu cecair**|
X means liquid.
3. |**masukkan dalam** table **kamu**|
Put in your X.
4. |**tulis** base **tu duluuu mana** haa!|
Note where the X is first haa!
5. |**apa dia perkaataan-perkataan yang digunakan dalam** pattern?|
What are the words used (to describe) X?

The utterances above have no meaning without the inserted L2 components as seen in the translation. The practice of L2 insertions shown here can be taken as the teachers' survival strategy in response to language policy they were charged to implement. The intra-unit code-switching facilitated the teachers' delivery and student comprehension. The L1 components in the units provided the structure to their thoughts while the L2 insertions completed the thought and simultaneously familiarized students to L2 vocabulary. This finding corroborates the teachers' statement that developing students' competence in L2 was not a major concern in instruction (see Extracts 5.21T to 5.24T).

It also supports the teachers' educational end which is to familiarize students with content vocabulary (see Extract 5.22T).

Closer examination of the Mix category revealed that just using two words enabled the teachers to formulate an utterance for this category. In fact, code-switching using two words was the highest (109 counts) within the transcripts. Below are some examples to show how this was done to realize different pedagogic functions:

Extract 4.2

1. |**bahan** good| (evaluation)
Material good.
2. |ha **ini** before| (informative)
Ha this is before.
3. |non-absorbent ok **tidaak?**| (truncation)
Non-absorbent ok (means) does not?
4. |**tengok** transparent| (directive)
Look at transparent.
5. |classify **apa?**| (questioning)
What is classify?

Just like L1c, the majority of units in the Mix category followed L1 grammatical structure. This clearly helped to simplify the construction of utterances as the Malay structure is simpler to handle in many cases. In example 2, Farina's use of *ini* (this) eliminated the necessity to deal with subject-verb agreement in the use of the pronoun *this*. Example 4 shows how the use of *tengok* (look) freed Zuleyka from having to choose the correct phrasal verb. Example 5, also produced by Zuleyka, is another instance of an L2 utterance which is based on L1 syntax. The L2 equivalent would require the correct combination of a question word and verb. Moreover, the selection of the verb would need careful consideration in terms of agreement in number and time.

Simplified talk also occurred when code-switching was beyond the two-word level as shown below:

Extract 4.3

1. |**tajuk ujian** measuring length|
The test topic is measuring length.
2. |**tak kisah** eraseer, pencil|
It doesn't matter if it is an eraser, or a pencil
3. |aa **beg ni** wet or dry?|
Aa is this bag wet or dry?
4. |ok teacher **nak kamuu** measure|
Ok teacher wants you to measure.

Code-switching as shown in (1) allowed Ruhani to omit the linking verb. This is an acceptable practice in L1 (Loga, 2005). The use of *tak kisah* (it doesn't matter) in the second example made it possible for Farina to convey her message efficiently. In (3), by resorting to the use of L1 grammar Farina avoided the tricky L2 grammatical structure which needs the use of a verb and also the switching of position between the subject and the verb as required in questioning. Similarly, example 4 which was constructed based on L1 syntax allowed Ruhani to omit the use of the preposition *to* before the word *measure*. All these examples are evidence of the teachers' pragmatic approach to the teaching of science through English policy. Instead of speaking completely in the target language, which might have posed problems for them, the teachers relied on their strategic competence to pepper their talk with L2 constituents where possible.

In other studies (Kim & Elder, 2005; Polio & Duff, 1994) utterances under L2c had retained most of the characteristics of the target language and so were regarded as L2. Based on this, it was presumed that L2c was least frequent in the current study because of the difficulty involved in producing utterances that retain features of the L2. However, a scrutiny of the utterances revealed that they were more L2 only in terms of their lexical composition. With respect to syntax, the majority of L2c utterances still had strong L1 influence. This influence was readily detected when the L2c utterances were subjected to translation which produced acceptable L1 spoken units.

Extract 4.4

1. |most amount of water collected **yang mana?**|
Most amount of water collected is which one?
Terpaling banyak air bertakung yang mana?
2. |after water **apa?**|
After water is what?
Lepas air apa?
3. |ok grouuup shahida **awaaak** draaaw aaa table fan|
Ok grouuup Shahida you draaaw aaa table fan.
Ok kumpulan Shahida awak lukis kipas meja.
4. |rice cooker **ada** light|
Rice cookers have a light.
Periuk nasi elektrik ada cahaya.

In other instances, utterances were coded as L2c only because the teachers were able to lift chunks of L2 components from their teaching materials. This means that the L2c units produced did not require difficult linguistic manipulations by the teachers:

Extract 4.5

5. |ok **tulis** plant leaf coins spoon paper haa|
Ok write plant, leaf, coins, spoon, paper haa.
6. |ok aaa **tengok pulak** make the following the amount of water collected|
Let's look then at make the following the amount of water collected.
7. |number ooone **awak lukis** two batteriiiiies {one switch} one swiitech oooff ooone bulb|
Number ooone you draw two batteriiiiies {one switch} one swiitech oooff ooone bulb.
8. |**masukkan** silk cotton paper|
Add silk, cotton, paper.

One finding that separates the insertions made in L2c from those in L1c is the low occurrence of nouns (10 counts). The majority of insertions in L2c are related to questioning in L1 (25 counts). These are components like *ke* which is a spoken form of the particle *kah*, *kan* the spoken form of the tag-question *bukan*, and the question word *apa*. This strategy enabled the teachers to simplify questioning as can be seen in the following examples:

Extract 4.6

1. |haa transparent **ke** [translufən]?|
Haa is it transparent or translucent?

2. |little amount of water **ke** [mɔs] amount of water?|
Is it little amount of water or most amount of water?
3. |three types of soil **kan**?|
Three types of soil, right?
4. |**kan** one switch off one switch on?|
Isn't it one switch off (and) one switch on?
5. |ok **apa dia** [ɔpek] transparent object?|
Ok what is opaque (object), transparent object?
6. |water in Malay **apa**?|
What is water in Malay?

Clearly, L1 was not only used in the teachers' talk, its influence was also ever present in L2 units and units with insertions that teachers performed. In fact, many instances of L2 and L2c utterances can pass as camouflaged forms of L1.

The above findings are based on a tally of language used by teachers in the five categories throughout three lessons they taught. In order to see if teachers were consistent in their language choice, individual lesson by the teachers was also examined (see Table 4.3).

Table 4.3: Language Choice in Five Categories in Individual Lesson by Three Teachers

Ruhani					
Lesson Language	Circuit	Measure	Energy	Total	%
L1	142	159	36	337	40.2
L1c	33	25	17	75	9.0
L2	138	67	157	362	43.2
L2c	10	9	7	26	3.1
Mix	19	12	7	38	4.5
Total	342	272	224	838	100
%	40.8	32.5	26.7	100	
Farina					
Lesson Language	Absorb	Spring lab	Review	Total	%
L1	130	200	175	505	40.2
L1c	28	63	73	164	13.1
L2	228	82	191	501	40.0
L2c	5	9	10	24	1.9
Mix	21	19	20	60	4.8
Total	412	373	469	1254	100
%	32.9	29.7	37.4	100	
Zuleyka					
Lesson Language	Transparent	Soil	Magnet	Total	%
L1	239	116	8	363	26.5
L1c	93	52	6	151	10.0
L2	189	197	349	735	53.6
L2c	20	14	6	40	3.6
Mix	44	29	10	83	6.4
Total	585	408	379	1372	100
%	42.6	29.7	27.6	100	

Examination of the lessons individually showed that the amount of L2 and L1 used by all teachers varied from one lesson to another. Ruhani had more L2 count in only the lesson on energy. Farina recorded a higher L2 frequency in the *review* lesson and the lesson on *absorption*. Zuleyka's L2 use was higher in the lessons on *soil* and *magnet*. The difference between L1 and L2 use was very marked in some of the lessons. For example, there were 121 more units in L2 in Ruhani's lesson on *energy*. Her L1 units exceeded her L2 by 92 counts in the lesson on *measurements*. Zuleyka's lessons on *magnets* and *soil* recorded 341 and 81 more units of L2 than L1 respectively. Farina's L1 units exceeded her L2 units by 118 counts in the lab session on *spring*. In the lesson on *absorption* her L2 units topped her L1 by 98 counts.

During the interview, Ruhani commented that it was difficult for her to discuss some of the topics she had to teach:

Extract 4.1T

Some of the topics are difficult for teachers to explain but the students find them very interesting. Sometimes we struggle to recall the terminologies. That's why we unconsciously slip into Malay. Sometimes it takes us too long to recall. Rather than waste time thinking or referring to the dictionary, we might as well use Malay. That's what I usually do, anyway.

Her colleague, Salmiah, added:

Extract 4.2T

I learned words such as characteristics only during my PJJ (distance learning) (laughs). I wouldn't have come across it at the SPM (Malaysian Certificate of Education) level. No, not at SPM level. We are not even talking about the topic types of soil yet. You'll come across more bombastic words.

Zuleyka explained how she decided on her language choice in this way:

Extract 4.3T

I do a lot of Malay and English switchings for P&P (teaching and learning). But if it has got nothing to do with teaching and learning, I simply use Malay.

The variations in the teachers' language choice, as seen in Table 4.3, seem to support the teachers' claims that activities or topics covered in a lesson influenced their language choice. In Ruhani's lesson on *measurements*, for example, L1 use was dominant and she in fact began her lesson by leading a recitation of various science terminologies and their definitions in L1. Farina's lab session on *measuring spring extensions* was conducted mostly in L1 because it involved many complex directives.

Farina explained that getting stuck while teaching often caused her to revert to L1:

Extract 4.4T

In the beginning, I tried to speak English. But (the kids) couldn't comprehend (laughs). It was ok to use English in the beginning when (I was) not trapped. But (when the kids) couldn't follow, I had to stop. The kids are dead ducks if I cannot make them comprehend.

What she experienced was similar to Teacher T in another study (Macaro, 2001) who felt that L1 fallback was necessary because she was not good enough at modifying her L2. Farina did better in the review lesson on *spring* and the lab session on *absorption*

where more L2 use was recorded. She was able to do this because there were many opportunities to use or recycle simple L2 structures to accomplish various teaching acts. Similar observations were made in Ruhani's lesson on *energy* and Zuleyka's lessons on *soil* and *magnets*. These findings are consistent with the teachers' perceptions of their L1 use as stated in the interviews. When asked to indicate how much L1 they still used in their science classrooms, Ruhani indicated 50%; Farina over 50% and Zuleyka 30%. However, they also qualified that the extent of L1 use depended on students' achievement level and what they and their students can cope with (see Section 5.3, Extract 5.4T). According to the teachers, at times the use of L1 was unavoidable due to teacher and student related factors. The following example from Farina's corpus supports the teachers' claims.

Extract 4.7

1. Farina |ok what the meaning of absorb? aaa absorb|
2. |**ok satu hari ya satu hari air kat rumah tumpah jadi apa yang kamu ambil?**|
Ok one day, yes, one day the water at home spill so what would you use?
3. Students **Kain**
Cloth
[
4. Students **Tuala**
Towel
5. Students **tuala, tuala**
Towel, towel
6. Faiz **Menyerap**
Absorb
7. Farina |ok {teacher} teacher **nak cerita ni**|
Ok {teacher} teacher wants to tell a story.
8. |**ok kamu ambil air ya satu hari kamu ambil aiiir**|
Ok you carried water yes, one day you were carrying water.
9. |**tiba-tiba terjatuh air tumpaaah**|
You fell suddenly and the water spilt.
10. |**apa yang perlu kamu ambil?**|
What do you need to get?
11. Faiz Mop
12. Lyana **Tuala**
Towel
13. Faiz **tuala, kain lap**
Towel, wiping cloth
14. Farina |**ok kain lap betul?**|
Ok wiping cloth, correct?
15. |**ok kenapa kamu ambil kain lap?**|
Ok why (do) you get a wiping cloth?
16. Husni **sebab nak lap air**
Because want to wipe (the) water.
17. Lyana **lap air**
Wipe (the) water.

18. Farina |**nak hilangkan nak hilangkan...**|
Want to remove want to remove...
19. Students **Air**
Water
20. Farina |**ok apa peranan kain tu?**|
Ok what's the role of the cloth?
21. Students **menyerap, menyerap, menyerap**
Absorb, absorb, absorb
22. Farina |**ha tugas dia...**|
Ha its role...
23. Lyana **menyerap air**
Absorb water.
24. Farina |**menyerap air**|
Absorb water.
25. |ok absorb|
26. |**menyerap**|
Absorb.
27. |ok you write that|
28. |**menyerap ok**|
Absorb ok.
29. |**haaa dia sedut air tu eh**|
Haaa it sucks up the water eh.
30. Students (talking)
31. Farina |ok I want you remember the word absorb|
32. |**menyerap**|
Absorb.

In this lesson, Farina wanted to introduce the concept *absorb*. She began in English by asking what Wong-Fillmore (1985) regards as a pseudo-question (1). Next, she used a scenario which was familiar to the students to make the concept concrete. However, because she was unable to continue in English she switched to L1. Her code-switching worked for the students as they were able to follow the talk and also participate in what appeared to be a joint construction of knowledge. By eliciting the purpose of using the cloth in the scenario (20), Farina managed to get the students to identify the word *menyerap* (21) meaning *absorb*. She repeated the students' response (24) and restated it in L2 (25). Then, she restated the L1 word for *absorb* (26). To encourage retention she directed the students to write both *menyerap* and *absorb* into their notebook (27-28). Next, she elaborated on the meaning of *menyerap* before reminding students that *menyerap* means *absorb* (31-32). What is revealed here shows that Farina was able to take advantage of students' everyday experience and connect it to the science she was teaching. However, it was difficult for her to keep to L2 due to her limited resources in

English. During the interview, she disclosed that lack of preparation prevented her from accomplishing more than this.

Observation notes and lesson transcripts revealed that all three teachers spoke less L2 when addressing students in small groups or talking to students individually. Additionally, students never initiated conversations with the teachers in L2 throughout the lessons. The teachers in response, more often than not, would also speak in L1 (see Extracts 4.9 and 4.36). Even Zuleyka, the highest L2 user and the only one who had explicitly requested her students to speak in English, was noted to renege on her own advice. This inconsistent behaviour was also noticed by Polio and Duff (1994) who reported that teachers urged students to speak the L2 but would not necessarily do so themselves.

4.3 Summary of Findings on Teachers' Language Choices

Despite their low proficiency, all three teachers in this study did attempt to use English in their science lessons. However, their use of English varied in terms of its amount and the way it was used. There was evidence that English language use in a lesson was constrained by the topics covered and the activities included. Observations revealed that English language use was also influenced by who was being addressed by the teachers. Teachers appeared to use more English when addressing the class as a whole but revert to Malay when talking to students individually or in small groups. The findings also revealed that it was difficult for teachers to sustain talk in English. Rather than neglect the use of English completely, teachers frequently reverted to Malay either by switching completely to Malay or performing intra-unit switches when it was difficult for them to continue in English. Additionally, the teachers were detected to rely on Malay grammar in structuring English language discourse units and utterances with code-switching.

4.4 Data Analysis of Teachers' L1/L2 Use and Pedagogic Functions

Teachers' Language Choice Preference for Pedagogic Functions

To enable the data analysis for this part of the study, the discourse units were first coded using categories which were drawn from the literature (Cazden, 2001; Fennema-Bloom, 2008; Kim, 2001; Kim & Elder, 2005; Sinclair & Brazil, 1982) or which emerged from the data. Descriptions of the codes and their examples are provided below. The highlighted unit numbers indicate where the examples are located.

Check

This is realized by “a closed class of questions such as *ok, finished, ready* or *any problems?*, which enables the teacher to assess the progress of a lesson and check if there are any problems hindering progress” (Kim & Elder, 2005, p. 364).

Extract 4.8

1. Farina |ok do you finish?|

Clarification

Clarifications are utterances made when the teacher is unable to understand or hear students talk clearly (Kim, 2001). An example of this is reflected in item 3 below. Clarifications can also be realized by a closed class of questions which imply ‘do you mean...?’ or ‘is it...?’ as exemplified by item 5.

Extract 4.9

2. Azri **cik gu dua puluh tiga cik gu**
Teacher twenty-three teacher
3. Ruhani **/haa? yang mana?|**
Haa? Which one?
4. Azri **tu haa dua puluh tiga insha allah kalau tak silap**
That one haa twenty-three god willing if (I'm) not mistaken
5. Ruhani **|yang ni?|**
This one (is it)?
6. Azri **tuu!**
That one!

Count

This is realized by a closed class of ordinal or cardinal numbers which functions to count the number of students or items. When the number of items in sequence is counted with a pause of one second or shorter, the whole stretch is considered as one unit (Kim, 2001).

Extract 4.10

7. Ruhani |cepatlah|
 Hurry up
8. |one two|

Cue

This category mainly consists of phrases such as ‘Hands up’, ‘Who can answer?’ etc. which enable bids and nominations to proceed.

Extract 4.11

9. Ruhani |ok who volunteer to draw a [səkət] number twooo?|

Directive

The literature often defines directives as acts which prospect a non-verbal action from the addressee and expect compliance (Sinclair & Brazil, 1982; Tsui, 1995). For this study, directives function to request a specific behaviour which can be either a verbal (see item 11) or non-verbal response such as opening books, writing etc. (see items 10, 12 and 15).

Extract 4.12

10. Zuleyka |ok **tengok** page 66 **tu** ok|
 ok look at page 66 ok
11. |ok read together|

Although directives are often realized by commands which are explicitly stated, they can also be merely implied (Kim, 2001). An example of this would be when the teacher says ‘enough’ or ‘all right’ which functions to direct students to stop talking or working (see item 14).

Extract 4.13

12. Farina |ok kamu lihat air kat dulang tu eh|
Ok you look at the water in the tray eh.
13. Students (Talking while some of their friends were putting experimental objects into the water)
14. Farina |ok baik dah|
Ok, all right enough.
15. |ok sekarang cuba kamu {angkat apa} angkat sikit bahan tu|
Ok now try {lifting what} lifting a bit of the material.

Echo

Echo refers to teacher repetition of student responses which does not indicate evaluation but rather acknowledgement that a message is received.

Extract 4.14

16. Ruhani |ok repeat again|
17. |Shahidah your groups|
18. Shahidah table fan
19. Ruhani |table fan|

Elicitation

This refers to questions which require a linguistic response. In this study, questions are divided into five sub-categories:

(a) *Genuine question*

This refers to questions about students or their opinions for which the teacher does not know the answer.

Extract 4.15

20. Zuleyka |{aaa do youuu er} do you er store the magnet befoore?|

(b) *Display question*

Display questions are interrogatives for which the teacher has an answer in mind. Questions are meant to ask students to display their knowledge.

Extract 4.16

21. Ruhani |how many forms of energy?|

- (c) *Request for Malay*
(d) *Request for English*

Request for Malay or English is made when the teacher elicits a direct translation from the students which requires them to formulate an answer in one or the other language. The request is made as a strategy to check students' lexical knowledge (Fennema-Bloom, 2008). Item 22 below is a request for Malay.

Extract 4.17

22. Ruhani |what means a wire?|
 23. Students **Wayar**
Wire.
 24. Ruhani |**ha wayar**|
Ha wire.

An act is also coded under this category when the teacher explicitly states the code students must use to respond.

Extract 4.18

25. Zuleyka |silt **dalam bahasa melayu**?|
(What) is silt in Malay?
 26. Students (silence)
 27. Zuleyka |ok class|
 28. |silt **dalam bahasa melayu apa**? |
What is silt in Malay?
 29. Students **Kelodak**
Silt
 30. Zuleyka |ok sand?|

(e) Truncation

This refers to “truncated statements or questions with rising intonation” (Kim, 2001, p. 50) which functions to invite student participation in the talk:

Extract 4.19

31. Zuleyka |this is an [ɔpek] ooob...?|
 32. Students Ject
 33. Zuleyka |object|

In this study, not all truncated statements were coded for truncation as truncation was also a strategy for genuine questioning. Thus, some truncated units were coded as display questions (see Section 4.13.1: Extracts 4.77 and 4.78 for further elaboration).

Empathy

Empathy is realized by any grammatical form which functions to show understanding of students' feeling or to make the atmosphere more relaxed.

Extract 4.20

34. Zuleyka |ok wrong answer|
35. |try again ok|

Evaluation

This is realized by words such as *no*, *excellent*, and echoing of a student's reply, with low or neutral intonation, indicating assessment by the teacher of the student's response in terms of its appropriateness (Kim, 2001). Utterances such as *ok* or *haa* which also indicate evaluation were not coded as this study was interested in evaluation which used either English or Malay lexis. These utterances did not fulfill this requirement. Item 39 below illustrates a positive evaluation.

Extract 4.21

36. Farina |clothe|
37. |clothe absorb or non-absorbent?|
38. Muaz Absorb
39. Farina |absorb ok|

Echoing of students' response in a questioning tone, implying negative evaluation is illustrated below.

Extract 4.22

40. Zuleyka |**apa maksud** yes you can?|
What's the meaning of 'yes you can'?
41. |yes aa yes **tu apa** yes?|
Yes aa 'yes' what does that mean 'yes'?
42. Rini **betul**
Correct
43. Zuleyka /**betuuul?**|
Correct?
44. |**yaaa**|
(It means) yes.

Expressive

This refers to teaching acts which imply disapproval, disagreement, frustration or tension. Coding for *expressive* was gleaned through intonation:

Extract 4.23

45. Zuleyka |**apa maksud** [əlo] some light?
What's the meaning of [əlo] some light?
46. |**hoi sini! duduk depan ni**
(Pointing to a spot in the classroom)
Hoi here! Sit in front here.
47. |**bersembang kau orang ha duduk situ**
You people talk when (you) sit there ha.

Informative

An informative functions to pass on ideas, facts, or opinions relating to the lesson (Kim, 2001). Explanations relating to procedures in a lesson belong to this category.

Extract 4.24

48. Zuleyka |ok magnet have a pole|

Label

A label is a statement which functions to assign a role to a student or a group of students (Kim, 2001).

Extract 4.25

49. Ruhani |Aidid iron|

Marker

Markers are realized items such as *well, ok, now, good, right*, etc that indicate boundary of topic or moves (Kim, 2001).

Extract 4.26

50. Farina |**jadi itu adalah** mv|
So that's mv.
51. |**ok baik**
Ok right.
52. |**sekarang kita nak cari**
Now we're going to look for
53. |aa we search responding [vairəbəl]|

Metastatement

A metastatement is “realized by a statement which refers to some future time when what is described will occur. Its function is to help students see the structure of the

lesson, and to help them understand the purpose of the subsequent activities and see where they are going” (Kim, 2001, p. 54).

Extract 4.27

54. Farina |ok now we check|
55. |ok we check and see which one aaa?|

Miscellaneous

Digressions or utterances which do not belong to any of the categories described were coded under this category.

Extract 4.28

55. Farina |**ha ni baju anak** teacher **ni**|
Ha this is teacher's daughter's dress
56. |**buat kain buruk**|
Used as a rag
57. |ok this cloothe ok|

Modeling-drilling

This is realized by any form of sentence or fragment which helps students to learn content or enable the teacher to drill pronunciation. Modeling and drilling are counted as one since they frequently occur simultaneously.

Extract 4.29

58. Zuleyka |read everybody|
59. |attract or repel|
60. Students attract or repel

Nomination

Nomination is realized by a closed class consisting of *you, yes* or other phrases such as *group 5*. It functions to call on or to give permission to a student(s) to give a response (Kim & Elder, 2005). Nominations with students' names are not counted in this research to avoid inflating L1 counts since all names would automatically fall under this category.

Extract 4.30

61. Zuleyka |yang mana? ok|
Which one? ok
62. Amir **saya saya saya saya**
IIII
63. Zuleyka |ok you ok|

Pointer

A pointer is realized by a closed class of phrases containing number items or sequential implications such as *the first one, page two*, or the topic given in the textbook. It draws students' attention to the point where their task is during an activity consisting of sequential tasks, and to facilitate smooth transition to the next phase of the lesson (Kim & Elder, 2005).

Extract 4.31

64. Zuleyka |ok check **pada** textboook paaage what page?|
Ok check in the textbook paaage what page?
65. |haaa eightyyy ok magnetic material|

Prompt

Prompt is realized by “a closed class of items such as *go on, come on, hurry up, quickly* etc., which reinforce a directive or an elicit” (Kim & Elder, 2005, p. 365).

Extract 4.32

66. Zuleyka |**apa dia** transparent?|
What is transparent?
67. |**cepat**|
Hurry up.

Reformulation

This refers to the reiteration or reformulation of what the teacher or a student has said or what is stated in a written text with no new instructional content (Fennema-Bloom, 2008). This category has three sub-categories:

(a) Recast

A recast is a repetition or rephrase of what the teacher or another student has said without being a direct translation (Fennema-Bloom, 2008).

Extract 4.33

68. Zuleyka |[ɔpek] object many eh|
69. |you have many example of {[ɔpek] object} [əʊpeik] object|
70. |ok [əʊpeik] object you haaave many example|

(b) Restatement

This is a direct translation of oral discourse and is generally unplanned (Fennema-Bloom, 2008).

Extract 4.34

71. Farina |ok **bahan** that can absorb water|
ok materials that can absorb water
72. |**bahan yang boleh menyerap**|
Materials that can absorb
73. Students **air**
water

(c) Text translation

This refers to direct translations of written text, and can be planned or unplanned (Fennema-Bloom, 2008).

Extract 4.35

74. Zuleyka |a transparent material|
75. Students a transparent material
76. Zuleyka |[əlo]|
77. Students [əlo]
78. Zuleyka |light|
79. Students Light
80. Zuleyka |to pass through|
|
81. Students to pass through
82. Zuleyka |**haa dia kata bahan lut cahaya {membenarkan} membenarkan cahaya melaluuu nya**|
Haa it says transparent materials {allow} allow light to pass through it.

Reply

A reply is a statement which functions to provide a linguistic response to a remark or a question made or asked by a student(s).

Extract 4.36

83. Halil **kita sambungkan ke?**
Do we continue?
84. Farina |yes **sambungkan**|
Yes, continue.

Review

This refers to a recapitulation of earlier contributions to the discourse to keep track of what has been discussed so that the occurrence of repetition can be minimized.

Extract 4.37

85. Ruhani |ok number 5|
86. |electrical energy solar energy kinetic energy sound energy| (Listing items already covered)

Starter

A starter is realized by a statement, question, or command. Its functions to provide information about or direct attention to an area in order to lead to a correct response to an elicitation (Kim & Elder, 2005).

Extract 4.38

87. Farina |aaa ok tengok perubahan nombor tu|
Aaa ok Look at the change in number
88. |kosong perpuluhan lima satu perpuluhan kosong satu perpuluhan lima dua perpuluhan kosong|
Zero point five, one point zero, one point five, two point zero
89. |aaa kamu tengok dia punyaaa nombor tu|
Aaa look at the numbers
90. |semakin apa?|
Becomes what?
91. Siti **semakin menaik**
Becomes more and more
92. Students **Menaik**
Increases
93. Farina |aaa nombor tu semakin besar kan?|
Aaa the number becomes bigger, right?

4.5 Findings on Pedagogic Functions and L1/L2 Use

The analysis of the teachers' language choices and their pedagogic functions showed that L1 and L2 were used for various teaching acts ranging from *checking* to monitor students' progress to *passing on information* relating to lesson contents and to *translating of text* to enhance comprehension. For a summary of each teacher's pedagogic functions and their dominant language type see Appendices 7, 8, and 9. Table 4.4 below shows the top five most occurring functions and the language type used for the functions in three lessons by the three teachers. The top five functions are

ranked 1 to 5 with the function charting the highest frequency ranked as 1. The bold prints show the functions which were performed in L2.

Table 4.4: Top Five Most Occurring Functions and Their Language Type in Three Lessons by Three Teachers

Teacher	Total L2 %	Most occurring functions and the language type used				
		1	2	3	4	5
Ruhani	43.2	Eva L2)	M-dr (L 1)	Dir (L1)	D-q (L2)	Dir (L2)
Farina	40.0	Dir (L2)	Dir (L1)	Rec (L1)	Res (L1)	Inf (L1)
Zuleyka	53.6	Dir (L2)	Rec L2)	M-dr (L2)	D-q (L2)	Eva (L2)

Notes: Eva = evaluation; M-dr = modeling-drilling; Dir = directive; Rec = recast; Inf = informative
D-q= display question; Res = Restatement;

Table 4.4 shows that none of the teachers used discourse units with insertions as the dominant language type in their top five most occurring functions. Instead, they all used either L1 or L2. Two of them appeared to use more L2 than L1. Zuleyka (the highest L2 user) had all five functions in L2 while Ruhani had used L2 in three of her top five functions. Farina (the lowest L2 user), in contrast, only had one category which was L2 dominant.

Interestingly, while the patterns of frequently occurring functions varied between the teachers, they shared one similarity. *Directive* in L2 appeared in all the sets of frequently occurring functions. Although *directive* did not appear in Zuleyka’s L1 set, its frequency was still high (72 counts). Further examination revealed that teachers tended to use L1 for complex *directives* (see Section 4.4: Extract 4.13, items 12 and 15) but L2 for the simpler ones (see Section 4.8.3.1: Extract 4.53). This suggests that some *directives* were difficult for teachers to perform in L2 and so they had to resort to L1. The high frequency of *directive* may be directly linked to the fact that four of the lessons involved doing experiments which required the teachers to give directions about management and procedural matters. The high occurrence of *directives* also

suggests that the science classrooms were for the most part teacher dominated and students were placed in a position to respond to teacher initiatives.

Table 4.4 is also revealing in that the top five functions in L2 within the sets required little linguistic manipulation. The ease in performing these teaching acts is probably why the L2 counts for them were relatively high which indirectly helped to boost the L2 counts for the teachers. To earn a count for *evaluation*, for example, a teacher only had to echo or use simple expressions like yes, no, good etc. *Modeling-drilling* likewise requires the verbalization of a word or short phrases or the reading aloud of texts from written materials for students to repeat after the teacher. Analysis of directives in L2 revealed that a count can be earned simply by uttering sentences like *come here* or *look in front*. *Directives* which required the use of unfamiliar nouns such as *shade* or *tray* were usually given through L1 or code-switching.

The high presence of *recast* (Farina and Zuleyka) and *restatement* (Farina) in the teachers' corpus showed that *reformulation* was an important strategy. It also suggests that a lot of teacher talk was repetitive and focused on meaning since *reformulation* involves the rephrasing or the translation of a preceding utterance without the addition of any new instructional content. The high frequency of L1 *recast* and *restatement* in Farina's discourse suggests it was difficult for her to make herself be understood solely by speaking in L2. The L1 *restatements* were also likely done to reinforce students' understanding of information contained in preceding L2 utterances.

4.5.1 Top Five Functions in L1 and L2 by Individual Teacher

This section compares the top five functions in L1 and L2 in the individual teacher's talk in order to provide a clearer picture of the patterns of language choice in relation to

pedagogic functions. The top five functions are ranked 1 to 5 with the function charting the highest frequency ranked as 1.

Ruhani

Table 4.5: Frequency Counts of Top Five Functions in L1 and L2 (Ruhani)

Total L1 units	Most occurring functions in L1									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
337	M-dr	64	Dir	61	Exp	39	Inf G-q	25 25	Rec Res	23 23
Total L2 units	Most occurring functions in L2									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
362	Eva	75	D-q	43	Dir	41	Poi	36	Rec	32

Notes: M-dr=modeling-drilling; Dir=directive; Inf=informative; G-q=genuine question; Rec=recast; Res=restatement; Eva=evaluation; Poi=pointer; D-q=display question

Ruhani's top five functions in L1 differed from her top five functions in L2 in a number of ways. *Modeling-drilling* was the most frequently occurring function in L1 but in the case of L2, it was *evaluation*. *Modeling-drilling* in L2 was rather low (4 counts) because Ruhani's lessons did not involve the introduction of much new lexical items or the use of written text; the two contexts in which teachers in this study were often noted to model and drill. *Directive* was the second most occurring function in L1 but third in L2 suggesting that it was easier to give directions in L1 than L2. *Expressive* was the third frequently occurring function in L1 but was not in the L2 set. In terms of linguistic skills, an *expressive* requires more out of a teacher. Thus, it is not surprising that it was more prominent in L1. Two categories, *informative* and *genuine question*, occupied the fourth place in L1 but were not in the L2 set. At the same rank in the L2 set was *pointer*. A simple explanation for this is that it is easier to realize a *pointer* than to *inform* or *question* students. It must be highlighted that while the frequency of *genuine question* was higher in L1 (25 units) than in L2 (4 units), there were slightly

more *informative* in L2 (27 units) than L1 (25 units). This suggests that there was a need to use both languages to convey information to students. *Recast* and *restatement* were fifth in Ruhani's L1 top most occurring functions but only *recast* formed part of her top five L2 set. This implies that more attempts at establishing meaning were performed through L1 rather than L2. This may be a reflection of Ruhani's goal which emphasized learning through L1. It must be noted that the frequency counts for *recast* in L2 (32 units) was still higher than that recorded in L1 (23 units). This implies that a lot of repetitive talk occurred in L2. As for *restatements*, the total for L1 (23 units) was about twice the total for L2 (13 units) indicating that translations of spoken discourse were mostly done in L1, possibly to increase understanding of L2 discourse components.

The high occurrence of *modeling-drilling* in L1 was due to Ruhani's decision to engage students in the recitation of science terminologies in one of her lessons. It was noted that students frequently did not wait for Ruhani to finish her turn to participate in the *modeling-drilling* but uttered information concurrently with her. This was Ruhani's explanation:

Extract 4. 5T

They (the terminologies) were already pasted on the students' desks. But the ones I pasted were in English and Malay. For the brighter students the English version alone would suffice. But with these Year 4 kids, I teach everything in Malay. So, we read only the Malay form. If they read (the terminologies) everyday, they'd comprehend. They would remember.

Her comments can be taken as a reflection of her teaching model which emphasized rote-learning and her belief regarding the importance of understanding in L1.

Evaluation was the highest in Ruhani's set of L2 functions (75 units) possibly because it is quite easily executed. This explains why there was no necessity to revert to L1 (16 units). This explanation applies to the use of *pointers* which function to direct students

to the point of attention in the talk. The high frequency of *evaluations* and *pointers* apparently helped to boost Ruhani's L2 counts.

Expressive was high on the L1 set of functions because misbehaviour was a constant problem in Ruhani's classes. During her lessons students were constantly seen and heard playing or talking. Some even walked around while she was teaching. Off task behaviours worsened during group work because Ruhani tended to give too much attention to some students but neglected the others. Additionally, misbehavior might have been stimulated by students' inability to understand her talk which was often disfluent and difficult to comprehend. Misbehaviour was a perpetual problem in her classrooms regardless of students' ability level. Resorting to L1 helped to give force to her words which explains the high frequency count.

The high occurrence of *reformulations* through *recasts* and *restatements* in L1 suggests there were frequent repetitions and translations. Analysis showed that *reformulations* were used mainly for self-corrections although on rare occasions they were used to increase L2 usage. The following extract shows how they occurred in Ruhani's talk:

Extract 4.39

1. Ruhani |**lebar dia** [wiʔ]?
Its width, [wiʔ]?
2. Halim One
3. Zura One
4. Ruhani |one aa one|
5. Shafiq one **setengah**
One and a half.
6. Alif a ah one **setengah**
A ah one and a half.
7. Ruhani |one **setengah**|
One and a half.
8. |aa ok one and half|
9. |ok do you understand how to measuriing?|
10. |**aaa awak tau macam mana nak ukur?**|
Aaa do you know how to measure?

Here, Ruhani was eliciting the width of an exercise book (1). The students reported their measurements and two students said theirs was *one setengah* (6 and 7). Ruhani repeated the code-mixed response and then restated it in L2 (8) perhaps to increase

input in the target language. Next, she checked if the students knew how to measure (9) but her question was not very well-formed. She may have realized this as she restated the question in L1 (10) to repair the damage. Poorly constructed L2 utterances were quite frequent in Ruhani's speech which necessitated *reformulations* in L1. Some examples of these are provided below:

Extract 4.40

1. |ok what is measuring?|
|**apa yang telah kamu ukur?**|
What did you measure?
2. |do you know how to symbol a wire?|
|**macam mana simbol wayar?**|
What's the symbol for wire?
3. |ok how many your [span] length for the table?|
|**berapa panjang meja awak?**|
How long is your desk?
4. |i will give you a some papeeer|
|**saya akan bagi sorang satu kertas** in {your group} your group of couple|
I'll give each pair a piece of paper

The above reflects the difficulty of expressing even simple thoughts in English for one who has limited skills in the language.

Farina

Table 4.6: Frequency Counts of Top Five Functions in L1 and L2 (Farina)

Total L1 Units	Most occurring functions in L1									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
505	Dir	112	Rec	68	Res	63	Inf	60	Exp	56
Total L2 Units	Most occurring functions in L2									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
501	Dir	125	Res	52	Rec	49	Eva	48	D-q	39

Notes: Dir= directive; Rec= recast; Res= restatement; Inf= informative; Exp= expressive;
Eva= evaluation; D-q= display question

Table 4.6 shows that there are similarities between Farina's talk and Ruhani's. Farina's talk also appeared to limit oral response from the students based on the teaching acts reflected in the table. All the functions except *directive*, to a limited extent, and *display*

question do not require verbal student participation but their attention. *Directive* which is the most frequent function in L1 and L2, for example, is often a request for non-linguistic response such as drawing, listening or copying. Likewise, it was unlikely for Farina to get a verbal response from the students for functions like *evaluation* and *informative* unless she made a mistake. Equally unlikely, was the possibility of getting a verbal reply for *expressive* since doing so would be regarded as offensive. A check against Appendix 8 showed that the categories *reply* (7 counts for L1 and 5 counts for L2) and *clarify* (2 counts for L1 and L2) occurred infrequently. This suggests that students rarely initiate talk, giving further evidence of teacher domination.

The table reveals that Farina made frequent *reformulations* judging by the high occurrence of *recast* and *restatement* in L1 and L2. Besides using *reformulations* to increase students' understanding in L1, Farina also appeared to use *reformulations* to increase input in L2. During the interview, Farina stated that:

Extract 4. 6T

My approach is different when I teach in English. I have to introduce the vocabulary first. I'd read some notes. I'd read together with the kids because they are weak, right? I'd read in Malay but the notes are bilingual...So, I'd photocopy the notes and read with them. They'd read after me. At the same time, if there are any words that are (difficult), I'd translate them into English. For example, pengawetan makanan I'd tell them in English we'd say food preser...what d'you call that? Prevation? Prever...(Asiah: Preservation) preservation haa preservation means awet. That's how I teach. I mean...I do the reverse but I don't just look at vocabulary in isolation.

The following is an example to illustrate how *restatement* was used to translate Malay vocabulary into English:

Extract 4.41

- | | | |
|----|---------------|--|
| 1. | <u>Farina</u> | apa bahan yang dibuat daripada besi?
<i>What material is made of iron?</i> |
| 2. | | iron? |
| 3. | Julia | Pembaris
<i>Ruler</i> |
| 4. | <u>Farina</u> | aaa ok ruler |
| 5. | | iron ruler |
| 6. | | right |
| 7. | | pembaris yang diperbuat daripada besi
<i>A ruler that is made of iron.</i> |

The first *restatement* was done when Farina translated the meaning of *besi* from her L1 utterance (1) by placing *iron* right after it (2). The second *restatement* occurred when she translated a student's reply in Malay (3) into English (4). She expanded on the minimal answer in L2 (5) and restated the meaning of her utterance in L1 (7). *Restatements* often occurred when Farina gave directives or conveyed the meaning of words to students. The following illustrates how directives were restated:

Extract 4.42

1. |**ok tulis tulis tulis tajuk**|
Ok write write write the topic.
|you write the topic|
2. |**ok lepas tu kamu aa buat keputusan**|
Ok after that you write aa the result.
|ok you do the result|
3. |**limaaa baris aje**|
Five rows only.
|five rows uh|
4. |**masukkan dalam table kamu**|
Put it in your table.
|ok you put in your table|

In these examples, Farina was not only able to translate her Malay instructions into English; she also appears to retain the structure of the Malay directives in her translations. However, her strategy was different when she tried translating functions other than *directives*:

Extract 4.43

1. |**apa lagi yang dibuat daripada getah?**|
What else is made of rubber?
|rubber|
2. |**sifat bahan yang digunakan tu mudah menyerap**|
The characteristic of the material is that it's absorbent.
|absorb|
3. |haa predict teacher **dah ajar dah macam mana nak kira nak {meramal} ramalkan**|
Haa predict teacher has taught you how to calculate, to {predict} predict.
|predict|
4. |**tujuan kajian**|
Purpose of the study
|purpose|

The L2 translations above can be categorized as elliptical since Farina did not attempt to translate the full version of her Malay utterances. By placing the key English words immediately following their Malay equivalents, Farina managed to accomplish *restatements*. This was an effective strategy which did not require her to construct complete L2 utterances. The students too could readily see the L2 equivalents of keywords in the L1 utterances as the probability of getting lost in processing long L2 utterances had been eliminated. Farina's L2 *restatements* were simple as illustrated above perhaps because that was what she could manage. During the interview, Farina commented: "Earlier on, I really tried to speak in English. I did try".

The presence of *directive* and *evaluate* in Farina's L2 set and the absence of *expressive* in the same set parallels the characteristics of Ruhani's set. This suggests that Farina too was inclined to use L2 for pedagogic functions which afforded her the verbal facility. The following excerpt reveals how Farina realized *expressive* in L1. The class had just finished discussing the three variables they had to identify in an experiment when Farina elicited the meaning of *manipulated variable* in L1 (1). A student answered *berubah* meaning *change* (4). Farina revoiced the answer with a *truncation* (5) prompting the class to supply *ubah* to complete the verb *berubah-ubah* meaning *changes* (6). Next, Farina cued the students to supply an alternative word (7). A student answered incorrectly (8) which angered Farina (9). She voiced her frustrations at the student's failure to remember (11-15):

Extract 4.44

- | | | |
|----|---------------|---|
| 1. | <u>Farina</u> | apa maksud mv?
<i>What's the meaning of mv?</i> |
| 2. | Basit | mv the length of= |
| 3. | <u>Farina</u> | = maksud dulu teacher tanya maksud
<i>Meaning first teacher is asking for meaning</i> |
| 4. | Lina | berubah
<i>Change</i> |
| 5. | <u>Farina</u> | berubah...?
<i>Change...?</i> |
| 6. | Students | ubah
<i>Changes.</i> |

7. Farina |**atau pun tidak...?**|
Or is not...?
8. Lina (unclear)
9. Farina |**sama!**| (In a raised voice because the answer was wrong)
The same!
10. Lina |**eh tak sama**|
Eh not the same.
11. Farina |**aa tengok dah lupa**|
Aa see (you've) already forgotten.
12. |**baru aje kita bincang soalan tajuk measurement tu**|
We just discussed questions on the topic of measurement.
13. |**boleh lupa lagi**|
(You) can still forget.
14. |**macam mana ni?**|
What do we do?
15. |teacher **nak rebus kepala kamu dalam periuk ke biar otak tu cair sikit?**|
(Do you) want teacher to boil your head in a pot so that your brain melts a bit?

The linguistic manipulation involved in this episode would not have been possible if Farina had attempted to express herself in L2, given her limited proficiency.

Zuleyka

Table 4.7 reflecting Zuleyka's top five functions in L1 and L2 shows very little variation from those examined earlier.

Table 4.7: Frequency Counts of Top Five Functions in L1 and L2 (Zuleyka)

Total L1 units	Most occurring functions in L1									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
363	Dir	72	Rec	56	D-q	39	Inf	26	Exp	23
Total L2 units	Most occurring functions in L2									
	Rank 1	Units	Rank 2	Units	Rank 3	Units	Rank 4	Units	Rank 5	Units
735	Dir	112	Rec	104	M-dr	95	D-q	79	Eva	76

Notes: Dir = directive; Rec = recast; D-q = display question; Inf = informative; Eva = evaluation
M-dr = modeling-drilling.

However, the components of the L2 set from Table 4.7 seem to suggest that there was slightly more provision for student involvement in Zuleyka's classrooms. This is evident in the frequent presence of functions like *display question*, *modeling-drilling* and to some extent *directive* that require students to respond verbally. However, the student response triggered by these functions was unlikely to be creative. *Display questions*, for example, are known to elicit short answers. Even less creative is the

response to *modeling-drilling* for which students repeat after the teacher. The findings suggest that there was not much room for creative communication in the lessons. Having *recast* in the L2 set indicates that repetition was frequent in her talk. Analysis of Zuleyka's L2 *recasts* showed that they were often her attempts at self-corrections (see Section 5.8.4.3: Extract 4.61). The high occurrence of *directives* in L1 and L2 implies that Zuleyka, like her colleagues, had enhanced her authority. The occurrence of *directive*, *recast*, *display question* and *informative* in the L1 set indicates that despite being a high L2 user, there was still a need for L1 to accomplish important teaching acts. The presence of *expressive* in the L1 set suggests that she too was inclined to express her emotions through L1.

4.6 Summary of Findings on Teachers' L1/L2 Use and Pedagogic Functions

As CBI instructors the teachers are expected to use English in as many teaching acts as possible in order for students to get the necessary support they needed to develop their skills in the language through their science lessons. The findings showed that the teachers did try to use English for various functions especially when it was convenient to do so. For example, functions which could be accomplished easily such as *pointers*, *evaluation*, elliptical *reformulations* and simple *directives* occurred frequently in English which helped to boost the teachers' confidence. In contrast, L1 was often used for expressing emotions and asking *genuine questions* as it was easier for teachers to do so. *Reformulations* particularly through *recasts* were not only used to increase meaning but also frequently used to perform self-corrections. This reflects the difficulties teachers faced delivering lessons through English. *Restatements* in L1 showed that translation was an efficient strategy to increase comprehension of L2 utterances. Despite their limited proficiency in English, teachers were documented performing *restatements* in L2. However, the L2 *restatements* were not always of high quality as they were often

elliptical in form. The *restatements* were believed to be the teachers' attempts at using English and increasing L2 input for their students. L2 *restatements* also were their strategy for focusing on form. L2 *modeling and drilling* was an additional strategy used to focus on form. Although ETeMS aims to develop students' English language skills and produce students who are active learners, the teachers' strategies seem to go counter to this. Findings revealed that on the whole teachers were unable to support students' English language development and teacher dominance in the classroom is still common. It was a challenge for teachers to remain consistent in their L2 use in realizing various pedagogic functions. Their limited English skills made it difficult to access many words and structures in the target language.

4.7 Data Analysis of Teachers' Command of English

The range of errors in the teacher talk

It is important for teachers in this study to use correct and appropriate English because through their interactions with students they not only can shape student output but also enable students to learn the English language. Furthermore, the accuracy of teachers' English language use can impact on their implementation of CBI in significant ways. In order to examine the teachers' command of English, this study turned to Chun et al. (1982) for its analytical tool. The framework consists of five categories: *word choice errors*, *syntactic errors*, *omission*, *factual errors* and *discourse errors*. In this study, *pronunciation errors* were also examined. Definitions of these errors are provided in Table 3. 2 in Chapter 3 and examples are in the relevant sections below.

4.8 Findings on Error Analysis

The findings revealed that on the whole, errors were especially frequent in four categories: *word choice errors* (275 counts), *syntactic errors* (198 counts), *omission*

(191 counts) and *pronunciation* (177 counts). *Factual errors* (12 counts) and *discourse errors* (26 counts) were relatively lower. The individual teacher's list of errors suggests that Ruhani was especially weak in *pronunciation* (68 counts) and selecting correct words (53 counts). Additionally, approximately 30 % of her errors involved *syntactic errors* and *omission*. She also made the most *discourse errors* implying that her L2 speech was difficult to understand. Farina's errors mostly involved *word choice* (177 counts) and *omission* (109 counts). *Syntactic errors* (62 counts) and mispronunciation (43) were also quite frequent. Among the teachers, she committed the most *factual errors* (6 counts) suggesting frequent distortions in imparted contents. Zuleyka committed the most errors involving syntax (105 counts). She also committed frequent *omission* (53 counts), errors in *word choice* (45 counts) and *pronunciation* (66 counts). Table 4.8 provides a summary of the errors just described.

Table 4.8: Summary of Errors in Three Lessons Conducted by Each Teacher

Teacher Error	Ruhani		Farina		Zuleyka		Total	
word choice	53	26.2%	177	44.2%	45	16.3%	275	31.3%
syntactic	31	15.3%	62	15.5%	105	38.0%	198	22.5%
pronunciation	68	33.7%	43	10.8%	66	23.8%	177	20.1%
omission	29	14.4%	109	27.2%	53	19.1%	191	21.7%
factual	2	1.0%	6	1.5%	4	1.4%	12	1.4%
discourse	19	9.4%	3	0.8%	4	1.4%	26	3.0%
Total	202	100%	400	100%	277	100%	879	100%

4.8.1 Findings on Factual Errors

Factual errors concern the facts or truth value of an utterance (Chun et al., 1982). In this study, *factual errors* were attributed to poor monitoring and language proficiency. The following illustrates an error related to the former:

Extract 4.45

- Omar teacher light **ke**?
Teacher is it light?
- Ruhani |**mana?**|
Which one?

3. Omar **Ni**
This one.
4. Ruhani |rice cooker **ada** light|
The rice cooker has a light.
5. |**mula-mula dia akan keluar light dulu**|
At the start the light will come on first
6. |**kita on suis**|
(When) we turn the ON switch on
7. Sarah **entah orang cakap light tak caya.**
I told you it's light but you don't believe me.
8. Omar teacher aaa light **dulu ke** electrical energy **dulu**?
Teacher aaa light first or electrical energy first?
9. Ruhani |light light light light|

In this episode, students as a group were assigned to draw a picture of a rice cooker and to write its transformation of energy. A student asked Ruhani if light energy was part of the transformation (1). Ruhani stated that it was (4) and elaborated that light would come on first (5) when the switch is turned on (6). The student appeared doubtful and asked whether light or electrical energy would be first in the sequence (8). Ruhani repeated her incorrect response (9). This error occurred not because Ruhani did not know her facts but because she failed to monitor her speech. Earlier in the lesson, she had established that electrical energy is the first form of energy generated.

The following error made by Zuleyka is another outcome of poor monitoring:

Extract 4.46

1. Zuleyka |ok what will happen if north pole face north pole?|
2. |what will happen attract or repel?|
3. Students Repel
4. Zuleyka |no attract attract|
5. |**tengok menarik menarik**| (Demonstrates with magnets)
Look attract attract.
6. |repel **tu menolak menarik** ok|
Repel means repel (the answer is) attract ok.
7. |this group|
8. |what will happen if north poole face south pole?|
9. |attract or repel attract or repel?|
10. |north pole and south pole attract or repel?|
11. Husni Repel
12. Zuleyka |no attract|
13. |attract **tarik**|
Attract, pull.
14. |**tarik** attract|
Pull, attract.
15. |repel **tu tolak**|
Repel is push.

Here, Zuleyka was eliciting the reaction when two like poles of magnets are brought together (1-2). The class chorused the correct answer (3). However, it was negatively evaluated (4) because Zuleyka forgot her question due to the repetitions she had been doing. This conclusion is based on the demonstration when she placed unlike poles together causing them to attract (5). The students became very confused during the episode but did not question her. One student, however, did not pay attention to the demonstration but focused on Zuleyka's verbal input. He appeared to connect the question: *What happens if like poles face each other?* with the incorrect feedback Zuleyka gave. Hence, when the next question was asked (8-10) the student incorrectly responded (11) likely because his answer was based on the incorrect feedback. This episode shows that while repetition may familiarize students with a linguistic structure, it can also affect the content learnt if talk is not monitored carefully.

The following language-related factual error was produced by Farina:

Extract 4.47

1. Farina |ok {controlling [vairəbəl]} controlling [vairəbəl] **ni ok kamu akan jumpa pada tahun empat nanti**
Ok {controlling variable} controlling variable this ok you'll encounter it in Year 4.
2. |**tapi sekarang ni teacher nak kenalkan kamu**
But now teacher wants to introduce this to you.
3. |**supaya kamu tak terkejut bila naik tahun empat nanti**
So that you won't be too taken aback when you go up to Year 4.
4. |**apa dia** controlling [vairəbəl]?
What's controlling variable?
5. Students [vairəbəl]
6. Farina |eh what is the controlling [vairəbəl]?
7. |ok controlling [vairəbəl] **maksud dia**
Ok the meaning of controlling variable.
9. |the unit of controlling [vairəbəl] is (0.1) **pemboleeeh ubah pemboleh ubah**
The unit of controlling variable is (0.1) variables variables.
10. |**dalam sains kita akan belajar tentang pemboleh boleh...? ubah**
In science we'll learn about varia...? variables.
11. Students [ubah variable]
12. Farina |**ok ada tiga sahaja pemboleh ubah**
Ok there are only three variables.
13. |eh **tiga**
Three eh.

14. |**bukan empat bukan dua**|
Not four, not two.
15. |**tiga**|
Three.

Here, Farina was trying to introduce the concept *variables* which she referred to as *controlling variable* (1-4). She code-switched to Malay to explain its meaning (9). Students were informed that they would learn about three variables (10-12). However, within the same lesson, as shown below, the phrase was given another meaning:

Extract 4.48

1. Farina |teacher **nak** controlling [vairəbəl] **ni mesti ada dalam buku**|
Teacher wants this controlling variable to be in your book.
2. |**salin**|
Copy.
3. |**lepas tu kamu buat ni**|
After that you do thiiiis.
4. |**ok kamu tulis ni**|
Ok you write this.
5. |controlling [vairəbəl] **sama** stone|
Controlling variable is the same as stone.
6. |ok **kamu buat** stone|
Ok you draw the stone.
7. |to chaaange the length of spriiing **lukis gambar** spriiing|
To chaaange the length of spriiing, draw the picture of the spriiing.
8. |ok to measure observe|
9. |**dua perkataan kamu boleh jumpa** measure or observe **yaaa**|
Two words you can find measure or observe yea.

In this explanation Farina referred to the stone in the experiment i.e. *the constant variable*, as the *controlling variable* (5). Hence, the understanding that a *controlling variable* is the super-ordinate of three variables described earlier must be revised. *Controlling variable* according to the second explanation is a co-ordinate with two other variables. The idea of *controlling variable* introduced by Farina in the examples above was not only confusing but difficult to understand.

More confusion occurred in the lesson on *springs*. In discussing *variables* Farina repeatedly used *to keep the same*, *to change* and *to observe* or *measure* as a simplified

reference to *constant variable*, *manipulated variable* and *responding variable*. When these phrases were not used, she habitually used abbreviated forms such as RV and MV:

Extract 4.49

1. Farina |{**bentuk**} **tak berubah bentuk**|
{Form} unchanged form.
2. |**tak berubah saiz**|
Unchanged size.
3. |**tak berubah warna ha tu dia**|
Unchanged colour ha that's what it is.
4. |ok **faham tak** to keep the same?|
Ok do you understand (the meaning of) to keep the same?
5. |understand to keep the same?|
6. Students Yes
7. Farina |you understand?|
8. Students Yes
9. Farina |yes ok|
10. |to change to change|
11. Iqbal **bertukar**
Transforms
12. Farina |haa **bertukar**|
Haa transforms.
13. |**atau pun berubaaah-ubah**|
Or changes.
14. |**tak sama maksud dia ok?**|
It means not the same ok?
15. |**kalau {dalam bahasa yang sains dia} saintifiknya** to keep the same **ni** fix|
If {in the language its science context} its scientific language, this to keep the same (means) fixed.
16. |to change **ni kalau dalam bahasa tahun empat besok kamu akan jumpa**|
This to change you'll come across it in the language of Year 4 science.
17. |to change **ni adalah {apa dia? To fix aaa tooo ni aaa}** (0.2) measuring [vairəbəl]|
To change this is {what d'ya call it? to fix aaa tooo this aaa} (0.2) measuring variable.
18. |mv yaaa haa measuring [vairəbəl]|
19. |ok {to change} to change **tadi kamu kata apaaa?**|
Ok {to change} to change what did you say earlier?
20. |**berubah...? ubah tak sama ok?**|
Change...? changes not the same ok?
21. Students [
Ubah
Changes

In this extract Farina began by explaining how *constant variable* got its name by citing examples of characteristics that had remained unchanged (1-3). Next, she attempted to explain the concept *manipulated variable* in her talk referred to as *to change* (12-14). After several false starts she stated that *to change* means *measuring variable* (15-17). Firstly, equating *measuring variable* to the phrase *to change* did not in any way capture the inherent meaning of things being manipulated in the term *manipulated variable*.

Secondly, she also used the phrase *to measure* to refer to *responding variable* later in the lesson. That caused difficulty in understanding how *measuring variable* is different from *to measure*. The errors, it was concluded, likely stemmed from confusion resulting from using abbreviations and then matching the wrong words to the letters. For example, instead of matching *m* with *manipulated*, Farina incorrectly matched it with *measuring* and instead of matching *c* with *constant* she matched it with *controlling*. Farina's lack of precision in her language use distorted the meaning of the concepts taught and made the lessons very confusing. This was evident when none of the students could answer test questions on the topic correctly, later on.

Upon checking, it was discovered that the phrases *to keep the same*, *to change* and *to observe or measure* were found in the Curriculum Specifications for Primary School Science and also the textbook. However, none of the scientific terminologies was found in any of these materials. Farina's decision to use the scientific terminologies in a way complicated the learning process. Because Farina lacked the linguistic competency required to manage the use of scientific terminologies, she made errors which were detrimental to student learning.

4.8.2 Findings on Discourse Errors

Chun et al. (1982) explain that *discourse errors* include errors beyond the sentence level such as inappropriate openings and closings, inappropriate topic nomination or switches and etc. In this study, discourse errors refer to vague or inappropriate utterances causing difficulty for students to respond. Code-switching appeared to enable teachers to avoid *discourse errors* beyond the sentence level and so it was decided that focus is given to sentence level errors only.

Analysis revealed that while Farina (3) and Zuleyka (4) made few *discourse errors*, Ruhani's record (19) was relatively high suggesting that she was the most difficult to understand. Here are some of the errors she made:

Extract 4.50

What was uttered	What was intended
1. ok firstly when you have make a one battery you can make at above below or top of below one battery	When you draw a circuit with one battery, you can draw the battery anywhere within the circuit.
2. ok what is measuring?	What did we measure?
3. ok what the body parts of measuring length form?	What part of the body can be used for measuring length?
4. how you know {the} the electrical form a electrical energy?	How do you know there is electrical energy?
5. how many your [span] length for the table?	How many finger span is the length of your table?

As seen above, Ruhani has problems verbalizing her thoughts not only in utterances involving complex structures, but also in simple interrogatives (2 and 3). To clarify her meaning in instances such as these, Ruhani usually resorted to reformulation in Malay. Thus, it can be said that the response Ruhani got was not because of her discourse competence but rather her strategic competence.

4.8.3 Findings on Word Choice Errors

Word choice errors encompass incorrect choice or incorrect addition of parts of speech and all types of function words. Within this category, more errors involving incorrect choice (237 errors) were detected than incorrect addition (38 errors). Table 4.9 shows the total number of incorrect choice made by each teacher.

Table 4.9: Word Choice Errors in Three Lessons Conducted by Each Teacher (Incorrect Choice)

Incorrect choice	Ruhani		Farina		Zuleyka		Total	%
	Total	%	Total	%	Total	%		
verb	8	17.4	32	20.6	11	30.6	51	21.5
preposition	4	8.7	11	7.1	3	8.3	18	7.6
noun	26	56.5	105	67.7	9	25.0	140	59.1
determiner	1	2.2	0	0.0	0	0.0	1	0.4
auxiliary	1	2.2	0	0.0	2	5.6	3	1.3
article	5	10.9	3	1.9	8	22.2	16	6.8
adverb	1	2.2	3	1.9	1	2.8	5	2.1
adjective	0	0.0	1	0.6	2	5.6	3	1.3
Total	46	100	155	100	36	100	237	100

4.8.3.1 Word Choice Errors: Incorrect Choice

Farina made more than three times the number of incorrect choice (155 counts) recorded for Ruhani (46 counts) and Zuleyka (36 counts). Apparently, the higher count was due to repeated errors. For example, 74 counts of errors resulted from Farina's habit of referring to herself as *teacher* instead of using *I* or *me*- a cultural transfer of Malay language habit. Six errors relate to the use of *pampers* instead of *diaper*. The semantic narrowing of the brandname *Pampers* to mean *diaper* among Malay speakers has been noted by Lim and Teoh (2007). Other errors shown below were attributed to her low English proficiency:

Extract 4.51

1. |ok i want you add the **word** e-n-t ya at the absorb **sentence** eh|
2. |you write thiiis answeeer ok (0.2) **byyy ten**|

In (1), Farina incorrectly used *word* and *sentence* instead of *letters* and *word* because she was unclear about these nouns. The phrase *by ten* was used in (2) because she did not know the phrase *ten times*.

Incorrect noun choice in Ruhani's data included the use of *span*, *couple/group of couple* instead of *finger span*, and *partner/pair*:

Extract 4.52

1. |how many your [**span**] measure that first|
2. |with your **couple**|
3. |**saya akan bagi sorang satu kertas** in your group your group of couple|
I'll give each person a piece of paper for each pair.

Although these errors can be attributed to her poor proficiency, it was noted that the word *span* was also incorrectly used in the textbook. This suggests that the MOE was not very thorough in its selection of textbook writers and the vetting of textbooks.

With regard to incorrect choice of verbs, most of the errors were linked to L1 influence.

The verbs in bold print below are words that were directly translated from Malay:

Extract 4.53

1. |**see** the front|
2. |ok **close** your mouth|
3. |ok **open** page 80|

The first two errors resulted when Farina chose inappropriate counterparts like *see* and *close* instead of *look* and *shut*. Although the words *see/look* and *close/shut* belong to the same semantic field, their use is not interchangeable in the above contexts. Farina's inability to exploit the lexical fields correctly is indicative of her lack of linguistic competence. However, had she used *shut* instead of *close* in (2) that would imply rudeness on her part, which was not her intention judging by the tone of her voice. The directive (2) was really a literal translation of the Malay directive *tutup mulut kamu* which means *stop talking*. This expression can be interpreted as severe reproof in Malay but not rudeness. The point that is being raised here is that even if a LEP teacher is able to produce a grammatically correct utterance, there is a possibility that the utterance may not show sociolinguistic competence in communication. Knowing a language involves knowing its register and this is something that is lacking in Farina's knowledge because of her low proficiency.

As for the third example, it is likely the result of literally translating the Malay directive *buka mukasurat 80* (open page 80) into English. *Pusing ke mukasurat 80* the Malay equivalent of *turn to page 80* is not an acceptable structure in Malay syntax. This explains the error in (3).

4.8.3.2 Incorrect Word Choice: Addition

Table 4.10 provides a summary of incorrect addition of words made by the teachers. None of the errors detected can be attributed to L1 transfer and so it was concluded that they were a reflection of the teachers' interlanguage.

Table 4.10: Word Choice Errors in Three Lessons Conducted by Each Teacher (Incorrect Addition)

Incorrect addition	Ruhani		Farina		Zuleyka		Total	%
	Total	%	Total	%	Total	%		
verb	1	14.3	0	0	0	0	1	2.6
pronoun	0	0.0	15	68.2	0	0	15	39.5
preposition	0	0.0	5	22.7	5	55.6	10	26.3
article	5	71.4	2	9.1	4	44.4	11	28.9
adverb	1	14.3	0	0	0	0	1	2.6
Total	7	100	22	100	9	100	38	100

Farina made the most incorrect additions and interestingly, they involved the use of the pronoun *you* in directives. Although the addition does not make the utterances grammatically wrong, it is generally not present in native speakers' speech.

Extract 4.54

1. |**you** look the picture|
2. |ok **you** look the table|
3. |**you** bring your green paper|

The following examples of incorrect addition from Zuleyka's data revealed that she had over-generalized the use of the phrasal verb *look at* by adding the preposition *at*:

Extract 4.55

1. |ok look **at** here|
2. |ok everybody look **at** here|
3. |ok look **at** here fooor explanation|

Ruhani was detected adding unnecessary articles as shown below:

Extract 4.56

1. |ok somebody have **a** three|
2. |today we have to learn **a**[səkət] |
3. |because there is **a** energy|
4. |I will give you **a** some paper|
5. |one we have a battery||**kalau** two or three we have **a** [be..?]|
(If there's) one, we have a battery. If (there are) two or three we have [be..?]

4.8.4 Findings on Syntactic Errors

Syntactic errors refer to errors of syntax involving tense, agreement, morphology, and word order. As shown in Table 4.11, most of the errors involved morphology (84 errors), followed by errors in agreement (50 errors) and tenses (46 errors).

Table 4.11: Syntactic Errors in Three Lessons Conducted by Each Teacher

Syntactic error	Ruhani		Farina		Zuleyka		Total	%
	Total	%	Total	%	Total	%		
word order	5	16.1	10	16.1	3	2.9	18	9.1
tense	2	6.5	22	35.5	22	21.0	46	23.2
morphology	16	51.6	30	48.4	38	36.2	84	42.4
agreement	8	25.8	0	0	42	40.0	50	25.3
Total	31	100	62	100	105	100	198	100

4.8.4.1 Errors in Morphology

Most of the morphological errors involved nouns and adjectives. The following are some of the morphological errors related to nouns found in the teachers' data:

Extract 4.57

1. |there are two [səkət]|(*circuit*)
2. |you add five **material**|
3. |ok here have {three three} three **type**|
4. |today {i want} I want you [meʒərəd] the some **thing** in the **classes**|
5. |four **component** and four **symbol**|

Negative transfer of L1 habit is believed to underlie these errors. In Malay, a plural noun is usually marked either by the duplication of the noun, or by using numbers such

as *lima* (five) or words that indicate many like *banyak* or *ramai*. The noun form rarely goes through any morphological transformation except in some cases of duplication like *bahan-bahan* (materials) or *batu-batan* (rocks). Example 4 showed that the teacher, Ruhani, was aware of the use of morpheme *s* to mark plural nouns in English. In fact, in (5) under Extract 4.56, she tried to teach this rule to her students. However, she obviously lacked the ability to monitor her language efficiently in running speech as seen above. This is also true for Farina and Zuleyka.

The following morphological errors related to adjectives were made by Farina:

Extract 4.58

1. |spring is very **long** (.) compare spring A and B|
*The spring is **longer** if you compare spring A and B.*
2. |copy to investigate the relationship between the number of marbles mv and the length of the [springs] extension rv|
*Copy to investigate the relationship between the number of marbles mv and the length of the **spring** extension rv.*
3. |bag **absorb** or non-absorbent?|
*Is the bag **absorbent** or non-absorbent?*

The detected morphological errors involving adjectives appear to originate from within the L2. Error (1) is a case of Farina not being sensitive to the comparative form of adjectives in English. Although a recast was done on this directive, the error remained intact. It could not be confirmed based on the other L2 utterances generated for this study if Farina knew about comparative adjectives. She appeared to have avoided the use of both forms of the comparative adjectives although opportunities were available; preferring instead switching to Malay.

The error in (2) is likely caused by overgeneralization of L2 rule associated with possessives. Farina might have perceived *extension* as something belonging to the *spring* and accordingly had added the morpheme *s* to it. In this way Farina had treated the adjective *spring* as a noun which according to English grammar would allow her to

add morpheme *s* to give rise to the meaning *the extension belonging to the spring*. Alternatively, the error in (2) might be the consequence of not knowing all of the noun/verb/adjective members of the *spring* word family. This could explain Farina's inability to recognize that the word *spring* placed before the noun *extension* would be an adjective. The same explanation applies to (3) and in which case, Farina's lack of linguistic competence was confirmed during the observation when she came to seek help. Farina was noted incorrectly using *absorb* instead of *absorbent* on 10 occasions in that lesson alone. The frequency count would easily double if contributions from the students were counted.

4.8.4.2 Errors in Agreement

Of the three teachers, Zuleyka made the most errors in agreement (42 errors). It turned out the lower counts in Ruhani's and Farina's data were due to the rare occasions in which the third person singular was used. The following examples were extracted from Zuleyka's and Ruhani's transcripts:

Extract 4.59

1. |ok nobody **have** plastic ruler (0.2) plastic ruler?|
2. |{ok aaa} ok who **want** {too} to try?|
3. |ok magnet **have** a pole|
4. |ok who **volunteer** to draw a [səkət] number twooo?|
5. |ok somebody **have** a three|

The notion of subject-verb agreement is not a part of Malay grammar (Loga, 2005). This is likely why errors in agreement were frequent as the teachers were inclined to rely on L1 language rules. Moreover, their perception that linguistic accuracy was not their aim (see Section 5.5: Extracts 5.22T to 5.24T) made them focus more on content being understood than developing language skills.

4.8.4.3 Tense Errors

The analysis of tense within syntactic errors revealed an interesting finding. Many errors were attributed to over-generalization of the present tense structure. The following examples show the teachers using the simple present tense instead of the future tense:

Extract 4.60

1. |and on Thursday ok we **try** go to some materials that absorb more water|
2. |ok today we **continue** the experiment ok|
3. |ok nooow we **go** question A|
4. |ok today we **have to learn** a [səkət]|
5. |ok I **go** to section B|

The following episode from Zuleyka's transcript showed her unsuccessful attempt at using the present perfect tense and her inclinations to use the simple present tense:

Extract 4.61

1. |{aaa do youuu er} **do** you **er store** the magnet befoooore?|
2. |**do** you **have been store** the magnet before|
3. |{do you} **do** you **store** a magnet {before before} before this?|
4. |**do** you **have** a magnet at home?|

As seen here, Zuleyka began with a question in the present tense which used the adverb *before* (1). Probably sensing that its structure was flawed, she rephrased the question (2). The use of *have been* in the recast indicates that she had an idea about the perfect tense but had problems accessing it. She reverted to the earlier version but this time adding the word *this* (3). The disfluencies in the question suggest that she was searching for the right structure. She finally succeeded in producing a grammatical utterance only after changing her strategy by substituting *before* with *at home*. The substitution permits her to use *do you have* to initiate the question. The following error by Ruhani also reflects her difficulty in using the present perfect tense:

Extract 4.62

1. |ok **are** you **finish**?|
2. |who **is** **finish**?|

The perfect tense is a feature of the English grammar that is difficult for Malay language speakers to grasp. In Malay, the speaker only needs to use *sudah* or *telah* (meaning *already*) to convey the meaning inherent in the perfect tense in English (Loga, 2005). There is no requirement to adjust the form of the main verb as is the case in English grammar. This could be the explanation for the above errors.

4.8.5 Pronunciation Errors

On the whole Zuleyka and Farina were able to pronounce most of the English words in their lessons. Ruhani, however, was less successful. When the mispronunciations in her lessons were brought to her attention, Ruhani commented:

Extract 4.7T

For me, science is not about language. Pronunciation is related to language, right? I feel when it comes to science, it's not about pronunciation aaa it's the facts (that are important)...it's not about that (pronunciation).

It is unfortunate that Ruhani should think this way. Lemke (1998) had pointed out that learning science involves learning to use the languages of science which include the use of words, symbols, images, and actions. As a result of not paying attention to pronunciation, Ruhani continued to mispronounce several common everyday items such as kettle, and toaster as [kitəl] and [tustə]. A few students appeared to know the correct pronunciations for these words and ignored her poor modeling. The majority, however, were documented to have acquired her mispronunciation. In her interlanguage, words such as span, width and picture were pronounced as [span], [witʃ] and [pitʃə]. A few able students in her class on occasions were amused by her mispronunciations, sometimes imitating her and laughing among themselves. Sometimes, her pronunciation confused students causing them to conjure up different meanings as shown below:

Extract 4.63

1. Shamem **picit?**
Squeeze?
2. Azhar picture lah **pekak** (Laughs)
It's picture, you're deaf
3. Shamem **picit tu apa?**
What's squeeze?
4. Rahmah picture **lah** (Laughs)
It's picture.

In this episode, Ruhani had just directed a pair of students to draw a picture of an object and to write the transformation of energy related to the object. Immediately after her directive, a student wondered why he heard *picit* (1). *Picit* is a Malay word which sounds close to [pitʃə] which was Ruhani's pronunciation of *picture*. The student obviously was focusing on the sound of the word but not its context and thus, was unable to make the connection (1 and 3). In contrast, his peer who was able to connect [pitʃə] to *picture* clarified this for him (2 and 4). He attributed his friend's inability to fathom Ruhani to poor hearing (2).

During that lesson too, a student heard me saying *kettle* while talking to her friend who had misspelt the word. She asked me this question in Malay: "Kettle eh teacher? Not kittle?" I told her it should be pronounced as *kettle*. She shared the feedback with the other students in her group.

The next episode is another example of a problem that stemmed from Ruhani's poor pronunciation:

Extract 4.64

1. Ruhani |what means a [səkət]?|
2. Faridah **Bulatan**
Circle (Confusing 'circuit' with 'circle')
3. Ruhani |[skət] **apa yang awak pakai tu?**
[skət] What's that you're using/wearing?
4. Shafiq **Seluar**
Trousers.
5. Ruhani |[skət] what means a [skət]?|
6. Students **kain, baju, seluar, kain**
Sarong, blouse, trousers, sarong

7. Ruhani |mm **ini li...? litar** [səkət]|
Mm this is a cir...? circuit [səkət]

In this episode, Ruhani was eliciting the meaning of *circuit* (1) and a student answered *bulatan* meaning *circle* (2). The response must have been triggered by the poor pronunciation of the word *circuit* which led the girl to offer *bulatan*. She probably thought that Ruhani was asking for the translation of *circle* which sounds close to [səkət]- especially with the transfer of L1 habit of not voicing final stops. The situation worsened when Ruhani restated the question in Malay using the word *pakai* which can mean either *use* or *wear* and fronted it with [skət] (3). It was a bad move as she appeared to lead a student to associate *pakai* with *wear* and [skət] with *skirt*. The student appeared to interpret the question as a request to name the clothing item he was wearing prompting him to answer *seluar* meaning *trousers* (4). When Ruhani restated the question and mentioned [skət] twice (5), other students started naming other clothing items (6) probably thinking that the question was an invitation to call out answers along that line. Realizing the discussion was going nowhere, Ruhani ended the episode by telling the students the meaning of *circuit* in Malay (7). A similar incident occurred in the same lesson:

Extract 4.65

1. Ruhani |what means a [bal]?|
2. Shafiq **bam minyak bam**
Balm, balm.
3. Ruhani |**bukan minyak bam**| (Raises voice)
Not balm.
4. Students (Laugh)
5. Ruhani |[bal] **tu apa?**|
What's a [bal]?
6. Shafiq **pakai bom**
Used in a bomb
7. Rohaya Bal
8. Shafiq **belon**
Balloon
9. Ruhani |{**satu litar**} one [səkət] we have a wire a [bal]|
{A circuit} one [səkət] we have a wire, a [bal]
10. |what means a [bal]?|
11. Shafiq **mentol**
Bulb.
12. Ruhani |**ha meentool** [bab] **tu men?**|
Ha bulb a [bab] is a bul...?
13. Students **mentol**
Bulb.

In this extract, Ruhani was eliciting the Malay equivalent of bulb (1). However, what was to be a simple Initiate-Respond-Feedback (IRF) routine was prolonged because students continued offering wrong answers (2, 6 and 8). It is believed the answers were triggered by Ruhani's poor articulation of the word *bulb* and her poor questioning.

All the teachers were not familiar with the International Phonetic Alphabets (IPA) and so were unable to use it to decode pronunciation. Consequently, problems arose during instruction as revealed by Farina:

Extract 4.8T

Like just now, I pronounced pigeon as pigen. I said pigen. Then a student corrected me, "Teacher, pigen or pigeon?" "Oh sorry, sorry pigeon aaa thank you". In a way, I also learned from my able students, right? How do you say burung hantu (in English)? (Asiah: Owl). I pronounced it as ol (laughs). Owl, owl.

Because they did not have this knowledge they went about guessing their way. The following shows Farina's guesswork on the pronunciation of *pebbles*:

Extract 4.66

1. Farina |what's the meaning of iron?|
2. Haliza **Besi**
Iron.
3. Omar **Besi**
Iron.
4. Farina |**besi**| |plastic?|
Iron.
5. Farah **Plastik**
Plastic.
6. Farina |**plastiklah**|
It's plastic.
7. |pebble?|
8. |[peblə]?|
9. Lyana [peblə]
10. Farah **batu batu kelikir**
Stones, pebbles.
11. Farina /**batu kelikir** right|
Pebbles, right.

In this extract Farina was eliciting the Malay equivalent of some words in English (1, 4 and 6). When it came to *pebbles*, she pronounced it correctly initially (7) but performed a recast and ended up mispronouncing it (8). Obviously, she did not know how to

pronounce the word and was guessing. Unfortunately, the mispronounced word was immediately rehearsed by a student (9). It was observed that when teachers mispronounced words or pronounced them poorly, students acquired the teachers' pronunciation because each topic extended over a few days. This means that opportunities were abundant for imprinting the teachers' pronunciation. Some mispronunciations quickly became ingrained as teachers modeled and drilled them in their effort to focus on form. To illustrate, the two lessons by Farina on *variables* recorded 30 mispronunciations of *variable*. In the single lesson on *circuits* and *measurement* students were exposed to Ruhani's poor pronunciation of *circuit*, *bulb* and *span* as often as 11, 15 and 16 times respectively. Twenty-four counts of mispronunciations were recorded for both *opaque* and *translucent* in Zuleyka's class.

Discussions with the teachers revealed that the deviant pronunciations detected were self-taught as nobody in the school could be relied on to help them (see Extracts 5.67T and 5.68T). The MOE recognized that pronunciation was going to be a problem and tried to minimize its occurrence by promising to supply dictionaries with CD-ROMs to teachers. However, the teachers revealed that the CD-ROMs were never delivered although the school received some dictionaries. Clearly, the MOE's failure to keep its promise had denied the teachers one possible solution to their pronunciation problems and the failure, as the findings in this section revealed, comes with a great cost.

4.8.6 Omission Errors

The table below provides a summary of omission errors present in the teachers' discourse.

Table 4.12: Omission Errors in Three Lessons Conducted by Each Teacher

Omission	Ruhani		Farina		Zuleyka		Total	%
	Total	%	Total	%	Total	%		
verb	12	41.3	41	37.6	18	34	71	37.2
pronoun	0	0.0	8	7.3	0	0.0	8	4.2
preposition	16	55.2	48	44.0	14	26.4	78	40.8
noun	0	0.0	1	0.9	0	0.0	1	0.5
conjunction	0	0.0	1	0.9	1	1.9	2	1.1
article	1	3.4	10	9.2	20	37.7	31	16.2
Total	29	100	109	100	53	100	191	100

The table indicates that the most frequently omitted component involved prepositions (78 counts) followed by verbs and articles (59 and 31 respectively). Omission of prepositions was the most frequent in the data for Ruhani and Farina (16 and 48 respectively) while omission of articles tops Zuleyka's list. Omission of prepositions was third on Zuleyka's list. All three teachers had verbs as the second most frequently omitted component of speech. The teachers appeared to show almost the same patterns in their omissions suggesting that they had similar inclinations. In terms of the total number of omission errors, the disparity between the teachers is great because the lessons examined were not of equal duration. Additionally, the activities in the lessons, frequency of code-switching and the length of the L2 units examined all had bearings on the errors made.

Quantitative analysis of omissions revealed that the verb BE attracted the most errors. All of the errors are believed to be the result of relying on the Malay language spoken structures. In Malay, the use of the linking verb BE is not required in cases such as the following:

Extract 4.67

1. |^ bag absorb or non-absorbent?
Beg menyerap atau tak menyerap?
2. |which one ^ MV?
Yang mana satu MV?
3. |ok group five ^ done|
Ok kumpulan lima selesai.

4. |^ ready|
Bersedia.
5. |this ^ how to draw a sym...?|
Ini bagaimana nak lukis sim...?

The Malay equivalents for all these utterances are grammatically correct and they do not require the use of any linking verbs (Loga, 2005). However, applying Malay structures to English utterances led to errors as English grammar requires the use of the verb BE. Similarly, the application of Malay structures failed in several cases which involved infinitives when the preposition *to* was omitted:

Extract 4.68

1. |after this I want ^ check your table|
Lepas ni saya nak periksa jadual kamu.
2. |ok I want you ^ remember the word absorb|
Ok saya nak kamu ingat perkataan menyerap.
3. |I want you ^ put down your pencil first|
Saya nak kamu letakkan pensel kamu dulu.
4. |if [əlo] any light ^ pass through thiiiis transparent|
Kalau benarkan sebarang cahaya lalu ini lutsinar.

Omission was also quite frequent in the use of phrasal verbs as the teachers tended to omit prepositions especially in the phrasal verb *look at*:

Extract 4.69

1. |look ^ the water|
Tengok air.
2. |ok you look ^ number one|
Ok kamu tengok nombor satu.
3. |you look ^ length 0.5 until 2.0|
Kamu tengok panjang 0.5 sampai 2.0.
4. |ok look ^ the picture eh in the textbook|
Ok tengok gambar eh dalam buku.

Just like the earlier errors, this omission is also linked to L1 influence. The English verb form used here appears to be a literal translation of the Malay *tengok*. The phrasal verb *look at* can be sufficiently translated into Malay with the use of the word *tengok* alone.

Translating *tengok* from Malay to English in the contexts above would require the use of a phrasal verb and failing to do so inevitably lead to ungrammaticality.

The unmistakable influence of Malay is also seen in the omission of the definite article.

Here are some examples:

Extract 4.70

1. |number five ^ last one ok|
Nombor lima akhir sekali ok.
2. |what ^ first step you must do it?|
Apa langkah pertama awak mesti buat?
3. |ok you search what is ^ MV|
Ok kamu cari MV apa.
4. |^ spring is very long|
Spring sangat panjang.
5. |please check and see which one ^ answer|
Tolong semak dan pastikan yang mana satu jawapan.

In these examples, the use of a Malay speaker intuition is evident in the omission of the definite article in the English utterances. The inclination to utter *first*, *last*, *MV*, *spring* and *answer* instead of *the first*, *the last*, *the MV*, *the spring* and *the answer* is probably because these utterances were based on Malay grammar which allows such omission (Loga, 2005). Malay speakers have two ways of knowing what is being referred to in these cases. In (1) and (2), the words *first* and *last* alone are sufficient clues for their referents whereas in (3), (4) and (5) the referents are readily understood from the context. Clearly, the English grammar requiring the use of the definite article would seem redundant and this might be the reason for the lack of its use here. Additionally, since the English grammar rule is not parallel to Malay grammar it must be learned and monitored carefully before its use becomes second nature. The teachers' poor mastery of English made it hard for them to monitor their speech efficiently during the fast paced lessons although there were times when they were observed to be successful.

Elsewhere, omissions involving pronouns similarly indicate that Malay syntax was relied on when speaking in English. The following examples were found in Farina's speech:

Extract 4.71

1. |ok give ^ to me now|
Ok beri kepada saya sekarang.
2. |ok I want you do ^ now|
Ok saya nak awak buat sekarang.
3. |ok you write ^ now|
Ok awak tulis sekarang.

While the English grammar requires the inclusion of direct objects for the verbs in these directives, it is unnecessary to do so in Malay. The reason is because the objects are understood from the context since these directives do not stand alone. By paying attention to what precedes them, a Malay speaker is able to attach meaning to these utterances. Perhaps, this was the reason that prompted Farina to formulate these utterances. She probably did not perceive anything odd in these statements especially since the students did not indicate any difficulty in responding to her instructions.

4.9 Summary of Findings on Error Analysis

The analysis on teachers' command of English revealed that teaching in L2 was fraught with problems. The teachers appeared to be restricted by their limited L2 resources to enable them to be dependable CBI teachers who could support students' attempts at learning science through English. Because the teachers' knowledge of English was inadequate, their English language was always riddled with errors as they were focusing on meaning but not form. They made frequent incorrect word selections, additions, and omissions. Additionally, their discourse units in English were often reduced in forms. Consequently, the English language that students were exposed to had the characteristics of foreigner talk (i.e. simplification of L2 talk resulting in grammatical distortions and the

use of common vocabulary items). The teachers' low proficiency did not make them very sensitive to the errors they committed or found in the textbook, rendering them incapable of helping students to focus on form. The rare occasions when teachers attempted to focus on form saw them breaking the grammar rules soon after highlighting them (see Extract 4.56: line 5) as they were inefficient at monitoring their English language. Occasionally, when the teachers attempted self-corrections, the result was that more erroneous English was exposed to the students as the teachers struggled to find the right structures.

Besides lapses in monitoring, the wide-ranging errors committed appeared to be strongly influenced by negative transfers from L1. Apparently, the teachers frequently thought in L1 when speaking in L2 and often their spoken English were really L1 structures dressed in L2 lexis. The findings revealed that some of the errors made affected intelligibility forcing the teachers to revert to Malay to ensure the fluidity of their lessons. Teachers' poor pronunciation sometimes confused students and derailed the progress of their lessons (see Section 4.8.5). Poor modeling also resulted in students acquiring peculiar pronunciation of various concepts as teachers were inclined to drill them. The mispronounced words quickly became ingrained when they were recycled in several lessons. It turned out that deviant pronunciation was the outcome of teachers' guesswork as there was no reliable help available in the school. As pointed out earlier, the answer to this problem through the use of a dictionary with a CD-ROM was denied them because there appeared to be a failure in the MOE's delivery system. It is important to mention that the errors made by the teachers not only impacted on the students' English language development but also their learning of certain science concepts. This study found that some of the errors caused distortion of taught concepts as teachers were mouthing words in English without a clear understanding of their meanings.

4.10 Quantitative Analysis of Teacher Questions in English

As explained earlier (see Section 1.13) it is necessary to examine teacher questions in order to determine the quality of questions and the kind of learning promoted by the questions. This enables the researcher to see how close the teachers' teaching styles are to the inquiry approach recommended by the science curriculum. Furthermore, teacher questioning is an important indicator of teachers' syntactic knowledge. In science, syntactic knowledge entails science process skills which include among others observing, making inferences, predicting, and interpreting data.

The quantitative analysis of teacher questions in this study examined aspects such as the pedagogic function of questions, opinion/factual dimensions and the type of responses sought. Also examined in relation to teacher questions was the quality of student response relating to word length and manner of response. The study draws from the work of Fennema-Bloom (2008) to examine the pedagogic functions of questions. Each discourse unit was coded as one of the following: display question, genuine question, request for English, request for Malay and truncation (see Extracts 4.15 to 4.19). To examine questions along the opinion/factual dimensions and the type of responses sought by the questions, categories were drawn from Good and Brophy (2000). For example, a question seeking opinion such as: *Why you use a wire?* was coded as *opinion*. In contrast, a question seeking factual information such as: *Which one clay?* was coded as *facts*. The type of response required were divided into three categories: *thought* if they required students to reason or explain (*e.g. because there is energy*), *fact* if they involved the recall of facts (*e.g. the type of marble*), and *choice* if they required only a Yes/No or either or response (*e.g. Attract*). Pontefract and Hardman (2005) provided the categories for examining student responses. Following their framework, a student response was coded as either *individual* or *choral reply*.

Choral replies were further sorted into *choral few* if they involved response by two to three students and *choral many* if they were to do with four or more students. Furthermore, the responses were divided into three categories: 1-word if they consist of one word (*e.g. Yes*), 2-3 words if they involved two- or three-word replies (*e.g. Heat energy, teacher*), and four words plus (*e.g. length of spring extension*).

4.11 Findings on Quantitative Analysis of Teacher Questions in English

The nature of question types and questioning techniques

The following sections provide the findings on the various aspects of teacher questions examined.

4.11.1 Pedagogic Function of Questions in English

The findings revealed that questions in L2 were distributed to four functions only. The distribution of these questions in the individual teacher's talk in three lessons is shown in Table 4.13 below.

Table 4.13: Function of Questions in L2 and Their Frequency in Three Lessons Conducted by Each Teacher

	Ruhani	Farina	Zuleyka	Total
Display question	43	39	79	161
Genuine question	4	3	7	14
Request for English	0	0	0	0
Request for Malay	4	16	5	25
Truncation	26	7	40	73
Total	77	65	131	273

The table shows that the teachers never used L2 to elicit a direct translation of Malay words into English (request for English). This suggests that the teachers placed little emphasis on checking students' lexical knowledge in L2. *Request for English* was also rare through Malay or code-switching (see Appendices 7, 8 and 9). Ruhani did not make any request for students to translate Malay words into English throughout her

three lessons but requested for Malay translations in four instances. In contrast, Farina recorded four *requests for English* but made four times more *request for Malay*. Zuleyka made eight *requests for English* compared to 38 for Malay. These findings are perhaps a manifestation of the teachers' belief that rural children understand science better in Malay (see Section 5.3). Additionally, it may be related to the teachers' perception of their role in teaching that is to enable learning through the language which provides a higher chance of success (see Section 5.5). *Display questions* was the most used questions by all three teachers suggesting that it was important for teachers to check that students were able to state what had been learned. The high frequency of *display questions* could also be influenced by the fact that teachers were teaching young limited English language learners. Using *display questions* could be the teachers' strategy of simplifying the delivery of content, and student response to their questions in order to be more inclusive. *Truncation*, a form of elicitation in which the query is at the end of the utterance, was also frequently used by the teachers perhaps because they are relatively easier for the teachers to formulate compared to other question forms. *Genuine questions* constituted only a small portion of the teacher questions. This corroborates the findings of other scholars (Mehan, 1985; Wragg & Brown, 2001) that teachers tend to ask known answer questions.

4.11.2 Opinion/Factual Questions

It must be noted that for the quantitative analysis, only truncated questions which were deemed as genuine checks on students' understanding were classified as questions and counted. Those truncations which were considered as habitual or the teachers' participation strategies were therefore excluded. As can be seen from Table 4.14, factual questions make up the majority of teacher questions. Some of these required

students to provide a translation of concepts, to state a quantity, to state a choice, name objects, or to identify items.

Table 4.14: Distribution of Questions Seeking Opinion Versus Factual Response in Three Lessons Conducted by Each Teacher

Question subcategory	Ruhani	Farina	Zuleyka	Total
Opinion	2	3	3	8
Factual	49	55	88	192
Total	51	58	91	200

Questions requesting for opinion are rare in this study. Out of a total of 200 questions, only 8 elicited opinion from the students. A similar finding was made by Wragg and Brown (2001). They reported that only 8 out of 100 questions asked by primary teachers involved higher-order questions. They noted that the key questions in the successful lessons they observed were related to the aims of the lesson. The lack of opinion seeking questions in this study suggests that the teachers were emphasizing their educational goal which is teaching to the test (see Section 5.5) examination of test papers revealed that opinion seeking questions were rare in examinations. This could be the reason why teachers gave little attention to these questions in their instruction. An alternative explanation is that teachers were influenced by their knowledge of their students. The teachers had revealed that students engaged better when asked to perform simple tasks in English. During the interview, Zuleyka stated:

Extract 4. 9T

Once I asked the students to explain... I asked them to explain the different processes of preserving food. I assigned one kid to explain canning, (another) bottling. They knew the processes but they didn't know how to explain them. They can respond when questions are simple. But (to talk about) a series of pictures or (manage) long narration, they can't.

Factual recall questions would certainly be easier for students to answer than opinion questions because they do not require much language use. This is confirmed by the findings on the type of response required by the questions.

4.11.3 Type of Response Required

Table 4.15 provides a summary of the responses required from students in the nine lessons observed.

Table 4.15: Response Required From Students in Three Lessons Conducted by Each Teacher

Response	Ruhani	Farina	Zuleyka	Total
Thought	2	3	3	8
Fact	45	45	40	130
Choice	4	10	48	62
Total	51	58	91	200

The table shows that teachers mainly requested students to provide factual answers (130 questions) or choose from available options (62 questions) when responding. The students were not often requested to reason or explain. This indicates that for the most part of the lessons, recall of facts took priority over discussions that could reinforce understanding. The fact that students were frequently expected to select from a limited range of options for their response also indicates that students were given limited opportunities to engage in talk about the topics covered. This was confirmed by the analysis of word length in student responses as seen in Table 4.16.

4.11.4 Characteristics of Student Response

Table 4.16: Length of Student Response in Three Lessons Conducted by Each Teacher

Word length	Ruhani	Farina	Zuleyka	Total
1 word	31	49	72	152
2-3 words	19	3	13	35
4 words plus	1	6	6	13
Total	51	58	91	200

Table 4.16 shows that students were rarely challenged to provide answers beyond three words. In fact, the bulk of student response was one word answers. The common

occurrence of replies (albeit brief) could be linked to teachers' desire to increase student participation. However, the brevity of the participation could be caused by the teachers' level of preparedness and their lack of English mastery. Teachers disclosed that they never considered writing out their lessons for preparation despite admitting they were anxious about teaching through English. During the interview Ruhani commented:

Extract 4.10T

I've already told you that I didn't prepare for this (lesson), right? Most of the time there's no preparation. That's why it's like this.

Her colleague, Salmiah added:

Extract 4.11T

Sometimes when we had the time, we had to look into other matters. Like just now for example...we're going to have a singing what d'ya call it? We are forced to dedicate our time for that. So, (preparation) depends on the availability of time, depends on needs. There were occasions when there's no preparation (laughs).

Given their limited proficiency in English, it is believed that depending on short-answer questions made delivery more manageable. While the teachers' strategy enabled their lessons to progress, asking questions requiring short answers certainly contributes little to students' English language development. The opportunity for students to develop their English language skills was further limited by teachers' inclination to invite choral answers.

Table 4.17: Manner of Student Response in Three Lessons Conducted by Each Teacher

Manner of response	Ruhani	Farina	Zuleyka	Total
Individual	13	14	37	64
Choral many	22	34	49	105
Choral few	16	10	5	31
Total	51	58	91	200

As shown in Table 4.17 choral answers are the most common response in all the lessons. The choral responses were often triggered by the need to emphasize a point

made either by the teachers or their students. Perhaps, this stemmed from the teachers' belief that students in general had poor retention of imparted information. Choral responses were also elicited to check if students were attentive. This was necessary as classes were on the whole big with population exceeding 30 students and with only one teacher in charge, the possibility of misbehaviour was real. Forgetfulness and unawareness also contributed to choral responses. Zuleyka explained she had problems remembering her students' names and so was unable to nominate them. Ruhani and Farina were unaware that their questions invited choral responses.

4.12 Qualitative Analysis of Thought Questions

The use of thought questions which have the potential of stimulating higher level thinking can lead to greater gains in understanding since they can yield a large number of responses from students (Wragg & Brown, 2001). In this study, this potential was not achieved because teachers did not plan for them and were not natural inquirers. The analysis revealed that the questions that were coded as thought questions were actually unintentionally asked. When they occurred teachers did not show skills at managing them.

In the following excerpt Zuleyka had just asked the students to state the type of soil that collects the most amount of water. The students had three choices: garden soil, sandy soil and clay soil. The class chose garden soil (1) which prompted Zuleyka to ask for an explanation (2). Omar responded (4) and Zuleyka echoed the answer in a questioning tone (5) before rejecting it (6). Omar made another attempt by contradicting his earlier answer (7). Zuleyka questioned his answer (8) but without waiting for his response, she restated her question (12). Again, without giving the student a chance to respond she terminated the episode by telling the class they could not possibly know the answer

because they had not learned about it (13). She promised to provide an explanation and to arrange an experiment at a later date and moved on (14).

Extract 4.72

1. Students garden soil
2. Zuleyka |ok why whyyy garden soil?|
3. |whyyy garden soil? huh?|
4. Omar **sebab dia banyak**
Because there's a lot
5. Zuleyka |**sebab dia banyak?**|
Because there's a lot?
6. |noo ok|
7. Omar **sebab dia sikit**
Because there's little.
8. Zuleyka |**sikit apa?**|
A little what?
9. |ok try speak in engliiish|
10. |try speak in english|
11. Mariam Yes
12. Zuleyka |ok why? why?|
13. |**ok sebab kamu tak belajar lagi kamu tak tau lah kan?**|
Ok because you haven't learnt this yet so you don't know, right?
14. |ok garden soil ok {teacher} teacheer **terangkan tapi nanti kita buat eksperimen dia**|
Ok garden soil ok {teacher} teacheer will explain but later we'll do the experiment.

Zuleyka's termination of the above episode showed that the thought question asked was unplanned. The manner in which she managed the unplanned question also showed her inexperience in managing exploratory talk. It is believed that Zuleyka had not had sufficient exposure to enable her to adopt it in her practice even if she had taught the lesson in L1 based on the questions she asked. Her lack of planning and skills conceivably prevented her from using the thought question as a chance to let students apply science process skills like formulating hypothesis or using previous observations of similar situations.

The following is further evidence to support the theory that lack of preparation and skills prevented thought questions from realizing their potential in generating discussions. In this excerpt Zuleyka directed the students' attention to the picture projected on the screen. She pointed out that the most water collected was in the

container under sandy soil (1 to 4) and that the least water collected was in the container under clay (5). She asked the students for an explanation (8 to 10). A student reasoned that the water went into the soil (11). Zuleyka only echoed the student's answer in a questioning tone (12) implying that the answer was incorrect. Instead of probing the student's response further, she terminated the episode by telling the student to hold the thought (13). Despite the students' readiness to explore, Zuleyka appeared unprepared to provide the scaffolding they needed.

Extract 4.73

1. Zuleyka |ok **bawah sekali bawah sekali** sandy soil water collected|
Ok the bottom most, the bottom most is sandy soil water collected.
2. |air {yang kitaaa} (.) yang kita {apaa} kumpul|
Water {that we} (.) which we what d'ya call it? collect.
3. |**tengok sini gambar ni aaa gambar ni aaa**|
Look at this picture aaa this picture.
4. |**gambar yang tengah tu kan air dia yang kita ukur paling banyak jumlah dia haa ni**|
The picture in the middle, right, our measurement showed that it had the most amount of water haa this one.
5. |and clay soil **paling sediii...?**|
And clay soil the leas..?
6. Students **Sedikit**
Least.
7. Zuleyka |**sedikit**|
Least.
8. |ok why?|
9. |**mana pegi air tu?**|
Where did the water go?
10. |**mana pegi air tu?**|
Where did the water go?
11. Student **pegi dalam tanah**
Went into the soil.
12. Zuleyka |**dalam tanah?**|
Into the soil?
13. |**ok tak apa kamu ingat tu dulu**|
Ok doesn't matter, remember this first.

Zuleyka's decision to proceed without giving a chance for her students to talk and think things through to understand a natural phenomenon in the above episodes could be related to her belief about learning. Based on her last utterances in the two extracts, Zuleyka seemed to perceive that students need to be taught in order for them to acquire knowledge. In this way, she presented herself as the authority for scientific knowledge.

This could explain why she did not use her questions to invite students to think and explore.

Poor handling of thought question was also noted in Ruhani's class. In her case, the problem was related to what Wragg and Brown (2001) referred to as pseudo-broad questions. This refers to a situation where a teacher expects a single correct answer even though there are other possibilities. Extract 4.74 illustrates this clearly. The episode took place after the class was informed that wires are needed to make circuits. Ruhani invited the class to explain the need for wires (1). Shafiq gave *electric* as his answer (2). Instead of appropriating the student's response to lead a discussion, Ruhani repeated her question (3). Shafiq expanded on his first answer (4). Ruhani acknowledged the answer (5) suggesting its relevance but at the same time signalled that it was not the answer she wanted by restating her question in L1 (6) - Note that she had switched to L1 from this point onwards. Shafiq being increasingly exasperated with the situation said the wire was needed to switch on the light and fan (7). Ruhani continued to goad him by asking: *For what?* (8) This time other students joined in the talk by repeating Shafiq's answer (9). Ruhani conceded (10) and decided to state the answer she had in mind (11).

Extract 4.74

1. Ruhani |why you use a wire?|
2. Shafiq |letrik|
Electric
3. Ruhani |why you must use a wire?|
4. Shafiq |**wayar elektrik**|
Electric wire.
5. Ruhani |**yalah**|
I know.
6. |**kenapa kita nak guna wayar tu?**|
Why do we need to use the wire?
7. Shafiq |**sebab nak buka lampu nak buka kipas**|
Because we want to turn on the light, turn on the fan.
8. Ruhani |**untuk apa?**|
What for?
9. Students |**untuk lampu**|
To use the lights.
10. Ruhani |**ha yalah**|
Ha yees

11. **[kita gunakannya untuk menyambungkan** to connect some component to another component|
We use it to connect to connect some component to another component.

This episode shows that although the initial question appeared to be open, Ruhani's handling of it made it more like a narrow question. Despite switching to L1 she was still unable to proceed because she continued restating the same ineffective questions instead of working on the students' answers. Obviously, Ruhani was targeting for one particular answer which the students could not identify. Ruhani's attempts to steer her students to the answer she wanted failed because she was not skillful at using questions to scaffold the talk. Her impromptu questions were not effective to focus students' thinking towards the direction she targeted even after switching to L1. Shafiq who tried very hard to respond but whose answers were always rejected was noticeably upset during this episode. Wragg and Brown (2001) had warned that pseudo-broad questions "can evoke frustration rather than information if pupils suspect that the teacher is merely fencing for a single preferred answer, rather than appealing to the imagination" (p. 20).

The following is another evidence to show Ruhani was unable to use questions for scaffolding talk. The following episode took place after the class had named several objects that have electrical energy in their transformation of energy. Ruhani attempted a question which required students to explain how they knew electrical energy was present in the transformation process (1). Azri explained that the objects need a plug (3). Farah concurred with him (4). When the class did not get any feedback from Ruhani, Roslan offered the answer: *There's a switch for electricity* (6). Ruhani continued to remain silent and this prompted other students to respond (7). Finally, Nurul explained that there is electric current (8). Apparently, that was the answer Ruhani wanted- it should be noted how she tried to restate the answer in English but was unsuccessful (9).

Extract 4.75

1. Ruhani |how you know {the} the electrical form a electrical energy?|
2. |**macam mana awak tau?**
How do you know?
3. Azri |**sebab dia pakai plug**
Because we use a plug for it.
4. Farah |a ah (agreeing)
5. Haris |Plug
6. Roslan |electric **ada** switch
There's a switch for electricity.
7. Students |(incomprehensible)
[
8. Nurul |**kerana arus elektrik**
because electric current
9. Ruhani |because of the electrical|

In this episode, Ruhani seemed uninterested in probing the students' answers although they were all relevant. By not taking the opportunity to do so, she did not capitalize on the knowledge that students had brought into the classroom. She prevented the students from connecting the science they were learning with their everyday experience. By not allowing students to explain their answers, she missed the opportunity to help the students refine their answers and indirectly their verbal skills.

4.13 Qualitative Analysis of Question Formations

The following sections describe the findings that emerged from the data relating to the teachers' strategies in forming questions. They include truncated questions, compound questions, elliptical questions, and wh-questions.

4.13.1 Truncated Questions

Chick (1996, cited in Martin, 1999) considers truncation "as *safe talk* which enables the participants in the classroom to collude in hiding unpleasant realities such as to hide their poor command of English; to obscure their inadequate understanding of academic content; and to maintain a façade of effective learning taking place" (p. 134). However, this study did not find this to be completely true. While truncation did give the teachers

a sense that students were participating in their lessons, it was not a strategy used to conceal their poor English proficiency or inadequate knowledge of content. Instead, it could be regarded as a display of what the teachers were able to manage given their limited proficiency in English. Truncation in this study, apart from being used as a strategy to invite student participation, and to do a quick revision as had been observed by other researchers (Martin, 1999; Pontefract & Hardman, 2005; Sinclair & Brazil, 1982), was also a reflection of struggling change agents' earnest attempts at framing questions. The following excerpt illustrates this:

Extract 4.76

- | | | |
|-----|----------------|--|
| 1. | <u>Zuleyka</u> | ok (.) ok first layer is...? |
| 2. | Students | dead plants and animals |
| 3. | <u>Zuleyka</u> | dead plants and aniii...? |
| 4. | Students | Mals |
| 5. | <u>Zuleyka</u> | dead plants and aniii...? |
| 6. | Students | Mals |
| 7. | <u>Zuleyka</u> | ok second layer iiis...? |
| 8. | Students | Water |
| 9. | <u>Zuleyka</u> | ok and theeen...? |
| 10. | Students | Clay |
| 11. | <u>Zuleyka</u> | and theeen...? |
| 12. | Students | Silt |
| 13. | <u>Zuleyka</u> | ok sand what the layer of sand? |
| 14. | | what (.) aaa |
| 15. | Omar | Five |
| 16. | <u>Zuleyka</u> | ok five eh five |
| 17. | | {last lay aaa} last layer of soil is...? |

The above episode took place as the class was looking at a picture of the layers of soil which was projected on screen. The visual had labels for the different layers. Instead of stating what the layers were Zuleyka opted to question the students by starting with a truncation (1). The students chorused their answer (2). Zuleyka echoed the response and perhaps for emphasis she truncated the final syllable of the last word (3). The students provided her the missing syllable (4). She repeated the truncated phrase (5). The students again chorused the missing syllable in unison (6). Zuleyka engaged her students in a series of chorus completion from that point onwards (7, 9 and 11). Later, she decided to change her questioning strategy by attempting a wh-question: *Which*

layer is sand? but failed to ask the question correctly (13). Framing wh-questions was difficult for Zuleyka and her colleagues. Truncation with its syntax which is declarative seemed relatively easier for them to construct and offered a means of circumventing communication breakdown.

The following is an example from Ruhani's class which reflects her limited skills in English:

Extract 4.77

1. Ruhani |when you have make a [səkət] you must have a...?|
2. Salina Wire
3. Ruhani |**apa?**|
what?
4. Students Wire
5. Ruhani |wire good|

In the above excerpt, Ruhani was eliciting the items needed to form a circuit. Instead of using a wh-question such as *what must you have when you want to make a circuit?* or *what do you need to form a circuit?* Ruhani chose a truncation. She signaled the interrogative by truncating the statement with a final rising tone (1). Salina understood the cue and responded (2). Perhaps, because she did not hear Salina clearly, she requested for clarification in L1 (3). The class chorused the answer (4). Ruhani evaluated the answer positively (5). The truncation in this instance was successful in serving its purpose but as can be seen above it was ungrammatical. The error could have been worse if Ruhani had attempted using a wh-question since that would have been more complicated.

Further reason to believe that truncation was not an attempt to hide inadequacies was based on observations that teachers also truncated their statements when speaking in L1 and when they had complete understanding of academic content such as shown below:

Extract 4.78

1. Farina |ok last one non-absorbent|
2. |non-absorbent ok **tidaak...**?|
|non-absorbent ok doesn't...?|
3. Noraini **menyerap**
|Absorb.|
4. Farina |**ok tidak menyerap**|
|ok doesn't absorb.|
5. |ok write down|

In this episode, Farina was checking on students' understanding of the meaning of *non-absorbent* in Malay. Instead of asking a wh-question, she used a truncation. A student understood the question and supplied the missing word (3). Farina accepted the answer and provided the complete translation in L1 (4). In this example, Farina could have completed her utterance without truncation as she knew what the missing L1 word was. It is believed that the truncation was done because it was an accessible strategy for questioning. The truncation is believed to be her genuine attempt at questioning and not just a strategy for encouraging participation. The alternative to the truncation such as *What is the meaning of absorbent?* was probably not chosen because it does not contain the clue she wanted to provide her students. The other option: *If absorbent means 'menyerap', what is the meaning of non-absorbent?* might not have been within her reach due to her limited skills in L2.

The following is also produced by Farina to show that truncation is her strategy for questioning. In this extract the class was trying to recall the words to describe patterns. The class had already identified the words *ascending* and *descending*. Farina wanted other descriptive words (1). When the answer was not forthcoming Farina used a truncation to clue the students in to the answer (3) instead of asking: *What is the word that begins with in?* which could have served the same purpose. This option was not selected probably because Farina did not know how to structure it. Similarly, in (10) Farina used truncation to elicit the word *decrease*. She could have asked: *What is the*

opposite of to go up? but that is an unlikely alternative since the word *opposite* is probably alien to both Farina and her students.

Extract 4.79

1. Farina |ascending descending **apa lagi selain kita boleh guna dalam** pattern?|
Ascending descending what else can we use in (describing) pattern?
2. Hasni ascending ascending descending
3. Farina |**selain** ascending (.) in...?|
Other than ascending (.) in...?
4. Saodah Insending
5. Hasni descending! aaa [asendin]
6. Iqbal increase!
7. Students Increase
8. Farina |increase spell increase|
9. Students i-n-c-r-e-a-s-e increase
Farina (wrote on the board)
10. |ok increase **menaik menurun**?| (silence)
Ok increase (means) go up, come down?
11. Hasni Increasing
12. Siti Decrease
13. Farina |decrease| (writes on the board)
14. Students Decrease
15. Farina |ok **atau pun** up...?|
Ok or up...?
16. Students Down
17. Farina |down| (writes on the board)

The teachers' proficiency in L2 was limited but it is believed that they did not try to hide this fact through truncation. Truncation was their coping strategy and based on observations it was also habitual, particularly for Zuleyka. She was prone to truncate her utterances as shown below:

Extract 4.80

1. Zuleyka |ok so i bring youuu a magnet|
2. |maaag...?|
3. Students net
4. Zuleyka |magnet ok|
5. |this is aaa example of magnet|
6. |this is a maaag...?|
7. Students net
8. Zuleyka |magnet|
9. |this is a maaag...?|
10. Students net
11. Zuleyka |magnet ok|
12. |this is {mag aaa magnet ok} bar magnet|
13. |haa bar maaag...?|
14. Students net

The above truncations are different from the ones described earlier as they appeared to be from force of habit. This habit is believed to be a negative transfer as speaking in truncated statements was also common in teachers' talk in Malay (see Extracts 4.34 and 4.65, items 72 and 12, respectively). Clearly, this habit could not make the teachers good change agents as student answers were not only brief; they were also sometimes mere nonsense syllables.

4.13.2 Compound and Elliptical Questions

Two forms of questions that emerged frequently from the data are compound question and elliptical question. Quirk et al. (1985, cited in Tsui, 1995) defined a compound question as a combination of a wh-question and an elliptical alternative question. For example: *Which ice-cream would you LIKE, CHÓcolate, vaNÍLla or STRÀWberry?* is derived from two questions: *Which ice-cream would you LIKE? Would you like CHÓcolate, vaNÍLla or STRÀWberry?* (pp. 74-75). The first is a wh-question while the second illustrates an alternative question. An elliptical question is a question with omitted component(s) but can still be understood from its context. The following contains compound and elliptical questions produced by Ruhani:

Extract 4.81

- | | | |
|-----|---------------|---|
| 1. | <u>Ruhani</u> | when {you} you use a lamp electrical or solar? |
| 2. | Sarah | light energy |
| 3. | Students | electrical energy electrical |
| 4. | <u>Ruhani</u> | electrical energy ok electrical energy |
| | | [|
| 5. | Students | Energy |
| 6. | <u>Ruhani</u> | after that? |
| 7. | | when you switch on the lamp? |
| 8. | Azri | light energy |
| 9. | Students | light energy |
| 10. | <u>Ruhani</u> | light or heat? |
| 11. | Students | Light |
| 12. | Haris | teacher (inaudible) |
| 13. | <u>Ruhani</u> | light...? |
| 14. | Farah | Energy |
| 15. | <u>Ruhani</u> | energy |
| 16. | Farah | baru heat energy
<i>Then only heat energy</i>
(Class was interrupted. Some students were called out) |

- | | | |
|-----|---------------|-------------------------|
| 17. | <u>Ruhani</u> | light energy lastly...? |
| 18. | Students | heat energy |
| 19. | <u>Ruhani</u> | heat...? |
| 20. | Students | Energy |

The episode occurred after the class had discussed about the seven forms of energy. In this excerpt, Ruhani was eliciting the transformation of energy when a lamp is switched on. Instead of asking: *What is the transformation of energy in a lighted lamp?* she had broken up the question into a series of questions. She began the sequence with a compound question: *When {you} you use a lamp, electrical or solar?* (1). Clearly, this question is a combination of the fuller form: *What is the first form of energy when you switch on a lamp? Is it electrical energy or solar energy?* In her version of the compound question Ruhani had performed an ellipsis on the fuller questions. This version is slightly different from the example given by Quirk et al. in which the speaker had retained the fuller form of the wh-question. The difference could be linked to Ruhani's limited proficiency as constructing the fuller wh-question would have been difficult for her. Fusing only the key ideas contained in the fuller questions simplified questioning for Ruhani. Similar quality compound questions also appeared in the lessons on *magnets* and *absorption* (see Extracts 4.85 and 4.86). Despite the grammatical distortion of the compound question, Ruhani was able to get a conversation going and the students did not show any problems understanding her. Once the compound question was uttered, Ruhani kept her talk minimal by asking a string of elliptical questions (6, 7, 10 and 17). The following are the ellipses produced by Ruhani and the possible alternatives for them:

Extract 4.82

What was uttered	Possible alternative
1. After that?	What's after that?
2. When you switch on the lamp?	When you switch on the lamp, what's the form of energy after electrical energy?
3. Light or heat?	Is it light or heat energy?
4. Light energy lastly?	Lastly, what does light energy transform into?

It is evident from this list that the alternatives require more linguistic skills which can be tricky for a change agent whose L2 proficiency is limited.

Elliptical questions were also generated by Farina:

Extract 4.83

1. Farina |what the meaning of iron?|
2. Rini **Besi**
 Iron
3. Muaz **Besi**
 Iron
4. Farina |**besi**|
 Iron
5. |plastic?|
6. Rini **Plastik**
 Plastic
7. Farina |**plastiklah**|
 It's plastic.
8. |pebble? [peblə]?|
9. Lina [peblə]
10. **batu batu kelikir**
 Stones, pebbles
11. Farina |**batu kelikir** right|
 Pebbles, right.
12. |rubber?|
13. Halil **Getah**
 Rubber

Here, Farina began with an almost fully developed interrogative sentence asking students to supply the meaning of *iron* in L1 (1). Two students answered correctly (2 and 3). Subsequent elicitations were merely elliptical questions performed by uttering the words being tested in a questioning tone (5, 8 and 12). The students understood the signal and responded accordingly. While this strategy enabled the lesson to progress smoothly, Farina did not appear to seize the chance to model questioning. The situation allowed for natural repetition of at least one questioning structure but with Farina's inclination to use elliptical questions, the opportunity was missed. In this study, missed opportunities were documented on several occasions. The following extract from Zuleyka's talk is an instance:

Extract 4.84

1. Zuleyka |what will happen if different pole {each other} face each other?| (Using magnets to demonstrate)
2. |what happen attract or repel?|
3. Rashid repel (This student has been talking all the time Zuleyka was teaching)
4. Zuleyka |repel very good|
5. |re...?|
6. Students Pel
7. Zuleyka |pel|
8. |ok north pole and south pole what happen?|
9. Students Attract
10. Zuleyka |attract or repel?|
11. Students Attract

In this episode Zuleyka could have repeated the question: *What will happen when X face each other?* in (2), (5), and (8), and the question: *Do they attract or repel?* in (2), (5), and (10). But in order to do these repetitions, of course, would require planning. Unfortunately, Zuleyka, just like her colleagues in this study, never planned her instructional scripts. By not planning, Zuleyka had denied students the chance to listen to good modelling of English. Lack of planning also prevented Zuleyka from developing her own English language.

The following episode reveals the missed opportunities in Farina's class:

Extract 4.85

1. Farina |clothe absorb or non-absorbent?|
2. Lyana Absorb
3. Farina |absorb ok|
4. |sponge absorb or non-absorbent?|
5. |what the result?|
6. |ok give to me now|
7. Faiz Absorb
8. Farina |absorb ok|
9. |plastic bag|
10. |plastic bag absorb or non-absorbent?|
11. Salman |non|
12. Farina |non|
13. |babies pampers?|

The elliptical questions (1), (4), (10) and (13) could be rephrased using the structure: *Is X absorbent or non-absorbent?* had Farina been more thorough in the planning of the lesson. Her inability to plan thoroughly resulted in students being exposed to frequent

substandard questions. Her use of such questioning method over time might just result in students using the same erroneous structure.

4.13.3 Wh-questions

Wh-questions formed a significant portion of elicitation in this study. The most striking feature of the questions examined must be the lack of the linking verb BE. The following are samples extracted from the teachers' data:

Extract 4.86

1. |what word first?|
2. |which one water?|
3. |what means a wire?|
4. |ok what the body parts of measuring length form?|
5. |what the meaning of purpose?|
6. |what first step you must do it?|
7. |how many layers here?|
8. |how many your [span] length for the table?|

The errors contained in these questions are mostly the result of negative transfer of Malay syntax for questioning. As described earlier, (see Section 4.9) negative transfers from Malay are prevalent in the teachers' talk which inevitably resulted in the wide-ranging errors discovered in this study.

Teachers were also detected relying on wh-questions which appeared like a substitution table. This was particularly common in Farina's talk:

Extract 4.87

1. |what the meaning of paaattern?|
|what the meaning of {absorb} aa absorb?|
2. |what is this?|
|what is the material?|
3. |which one mv?|
|which one responding [vairəbəl]?|

In these questions, Farina only had to change the noun in the final position to produce a new question. As shown above, her utterances were sometimes ungrammatical.

The following is an example of a substitution table-like questioning observed in Zuleyka's lesson on *magnets*:

Extract 4.88

1. |what happen if south pole {face each south er} face south pole?|
|what happen ok look at north pooole face north pooole?|
|what will happen if {north pooole} north pole face south pole?|
|what will happen if different pole {each other} face each other?|

The substitution table strategy would have worked well if the teachers had the required language proficiency. However, as teachers did not, they only managed to recycle structures from their interlanguage.

4.14 Summary of Findings on Teacher Questions in English

The study showed that questioning was not effectively used by the teachers to enhance students' English language development. This was evident in the minimal occurrence of request for English in their talk indicating that teachers placed little emphasis on learning English. It is believed that it was a self-fulfilling prophecy relating to the teachers' beliefs that rural students are not ready to study science through English and that using Malay provides a higher chance of success. The distribution of questions revealed that display questions seeking recall of facts were the most common in contrast to opinion seeking questions which were the least frequent. While questions seeking recall of facts were useful for encouraging the young limited English proficient students and checking their understanding of taught concepts, the manner in which the questions were framed and used was a concern. Most of the questions were elliptical or consisted of compound questions, and wh-questions which were poor in quality. The teachers' tendency to rely on certain erroneous questions repeatedly meant that students were repeatedly exposed to substandard English.

Another weakness in the teachers' techniques of questioning relates to frequent requests for students to choose from given alternatives. This contributed little to their language development and content learning. Also, the high occurrence of questions which invited choral answers meant that some students were able to disengage. The frequent use of truncations for questioning further weakened the potential of questions as a learning tool. Truncation provided teachers a simpler questioning strategy to manage and enabled their limited English proficient students to join in their talk. However, the talk students engaged in involved very little mental effort as truncations invited only brief answers. The brief answers as revealed in this study also included nonsensical syllables to complete final words in truncated statements. Just like choice questions, truncations did not challenge the students to construct complete utterances as the hard work was done by the teachers. Both truncation and choice questions prevented students from experimenting with their linguistic resources. This means students were not getting the practice they needed to gain confidence in using the target language.

The findings revealed that apart from missed opportunities to develop linguistic skills, teachers also were unable to seize opportunities to enhance content learning through inquiry. This is because the teachers did not plan their lessons thoroughly and seemed unclear about the purpose of their questions. They were inclined to ask questions randomly. Furthermore, teachers rarely asked thought provoking questions and some that emerged in the data were poorly dealt with. For example, Zuleyka's belief that students were incapable of discussing something not taught led to the premature termination of discussions. Thus, students were denied opportunities to engage in exploratory talk which could enhance their skills in formulating hypothesis and making observations. Constant focus on teaching to the test may also be partly responsible for the tendency to overlook the importance of engaging students to think. The use of

pseudo-broad questions targeting particular answers caused repeated rejections of students' imperfect but relevant answers because they did not match the teacher's answers. This was unfortunate as the answers were based on everyday experience which students had brought into the classroom. By not working on the students' answers the teacher was unable to help students look deeper to refine their imprecise answers. Finally, poorly sequenced questions did not encourage students to think with language about the contents they were learning. It is believed that this inability was due to teachers' lack of preparation and knowledge, and inability to think quickly on their toes. The teachers' shortcomings denied students the chance to express their thoughts or share their opinions in more involved ways.

4.15 Ways in Which the Nature of Teacher Talk of LEP Teachers Impact the Teaching of Science through English

There were several features of the LEP teachers' talk which affected the teaching of science through English. The findings showed that although the teachers attempted to use English, they were unable to depend solely on it to deliver their lessons. Many English words and structures were beyond their reach due to their limited knowledge base of English. These deficiencies prompted teachers to revert to Malay either by switching completely to Malay or by using intra-unit code-switching when faced with difficulties. Alternatively, they used only fragments of English. Topics and tasks included in lessons hold sway over the amount of English used. Students' ability level also determined the extent of English language used by the teachers besides the habit of reverting to Malay when talking to students individually or in small groups. Teachers were unable to keep English and Malay separate because recourse to Malay was often needed to perform various teaching acts. Teachers needed to use Malay for damage control and to reinforce their English language speech. Using Malay enabled teachers to be readily understood especially when asking questions about students and their

opinions, and expressing emotions. In essence, the use of Malay allowed their lessons to progress quite seamlessly. Furthermore, Malay offered an efficient strategy for translating various English concepts and instructions. This was important for the teachers to ensure that their goal of teaching to the test was achieved. However, this same goal weakened the teachers' potential as CBI instructors when it led them to insert English language concepts in code-switched utterances. Since teachers were prone to doing this, students were deprived of seeing how the concepts could be used in English language utterances. In many ways, the findings reported here are similar to those in a case study reported by Murphey (1997, see Section 2.7.3).

CBI is said to be a good platform for learning language because of the opportunities available to recycle language (Grabe & Stoller, 1997). This study discovered that the available opportunities in CBI can also be fertile ground for rehearsing and imprinting errors when the teachers do not have a strong knowledge base of the target language. The findings revealed that errors were ubiquitous and wide-ranging in the teachers' English language performance which automatically reduced the effectiveness of the teachers in the science through English classroom. The errors involved incorrect word selections, additions, omissions and deviant pronunciations. Many of the errors resulted from negative transfers from Malay. The analysis revealed that teachers often thought in Malay and transferred L1 habits and grammar rules when speaking in English. Frequently, their L2 utterances were literal translations of spoken Malay.

Errors were also a result of the teachers' weak knowledge base of English proficiency. Limited proficiency in English caused teachers to focus their talk on meaning and this inevitably resulted in ungrammatical utterances. By focusing on meaning the teachers disregarded their responsibility towards developing students' English language skills. This finding supports the observation that "in much of science education, language is

moved to the background or ignored, while thinking or doing are foregrounded” (Gee, 2001, p. 19). Meaning-focused talk caused teachers to choose words loosely, make incorrect additions, and commit omissions which resulted in imprecise and ambiguous use of English. The teachers’ inability to be grammatically correct not only affected students’ English language development but also their content learning as certain errors also distorted the truth of some information imparted.

The teachers in this study were restricted by their limited English proficiency to notice or be efficient at monitoring the errors in their language or in the textbook. Occasionally, when they sensed the errors they committed they frequently struggled to correct themselves. Their attempts at self-corrections inadvertently increased students’ exposure to poor models of English language use. This contrasts to the findings in other studies where repetitions were used to amplify the target language (Gibbons, 2002; Takashi-Breines, 2002; Wong-Fillmore, 1985). In this study, the repetitions in English were never deliberately planned to draw students’ attention to the structural features of the language while trying to provide comprehensible input.

Errors in the teacher talk also involved pronunciation. Some of the errors made were gross that they would be unintelligible to other speakers of English. Poor pronunciation sometimes confused students but most worrying was that students quickly acquired the pronunciation because they occurred frequently during talk- this is also true for structures with high occurrence. Pronunciation of English words was a major problem for the teachers because they did not have the resources to crack pronunciation codes. All the errors gave the teacher discourse the appearance of foreigner talk which is definitely not the kind of register aimed for by ETeMS. These errors certainly affected the quality of what students learnt and their output.

Wong-Fillmore (1985) believes that the language used by teachers serving LEP learners has two main functions. It is the tool to enable teachers to impart the knowledge and skills their students are supposed to learn, and it also “serves as the linguistic input on which these students can base their learning of English as a second language” (p. 20). The current study found that a weak knowledge base of English also disadvantaged the teachers in other ways. As their English language was limited, the teachers were unable to show richness of the language through the language they modelled. Consequently, they limited themselves to structures found in the textbook or used in examination questions. Limited proficiency also prevented the teachers from noticing, exploiting or planning for naturally occurring moments to focus on developing students’ English language skills. This study found many missed opportunities.

It has been established that scientists do not view science as just a body of knowledge but rather as knowledge acquired through the activities in the discipline that include rigorous questioning (Lemke, 1998). Knowledge of science has a lot to do with knowing how it comes to be. The MOE recommended that teachers adopt the inquiry approach to enhance the learning of content as well as to assist students’ English language development. This study found that teachers were not very successful at achieving these aims as they were not natural inquirers. Thus, they were not very successful at promoting a culture of investigation. In addition, they were not empowered to develop students’ skills in thinking critically or engaging in dialogue. The findings revealed that teachers were not clear about the aims of their questions and so were inclined to ask random questions. Because questions were asked at random, talk was terminated when it was realized that questions asking for information which had not been taught might not enable students to respond.

This study supports the observation made by Elder and Paul (1998) that most teachers are not themselves generators of questions and answers of their own. This means that they are not seriously engaged in thinking through or rethinking through their own subjects. The analysis showed that teachers in this study did not always use questions to extend discussions because they were not in the habit of “sending the ball back” when student answers did not match theirs. Consequently, the IRF pattern was adhered to, making much of the teacher talk authoritative and evaluative instead of dialogic. This denied students the chance to analyze and refine their imprecise but often relevant answers. This contributes to another flaw in the LEP teachers’ attempts at teaching science through English. Teachers are advised to appropriate student responses to bring depth and breadth to the lesson (Caram & Davis, 2005).

The review of literature on teacher questions had shown that questions can be used to develop language. Looking at the questions teachers asked in this study, it was clear that this potential was not realized. This is because there were simply too many instances of teacher questioning which were erroneous or confusing to enable questions to be used as platforms for developing language. Furthermore, the teachers’ habit of inviting choral answers and brief replies did not encourage students to engage in meaningful talk which could develop the students’ mind and enhance their English language skills. Clearly, the teachers did not heed Davis’ (1914) advice that, “You must always remember that in teaching the “material” you have to work is *mind*- the training and development of thought” (p. 31, emphasis in original). He believes that teachers can develop the student’s mind by asking problem or thought provoking questions “for very often, they are your only means of training thought” (ibid., p. 32).

In summary, the findings showed that knowledge of the second language is an important knowledge base for teachers who teach content through a second language.

Teachers must have control of the language to enable opportunities for it to develop along the development of content knowledge. Without adequate knowledge, teachers are unlikely to contribute very much to change such as intended by the ETeMS policy even if they tried using only the target language. It is important to note that “Productive talk does not just happen- it needs to be deliberately and systematically planned, just as we plan for literacy events” (Gibbons, 2002, p. 38). In order for deliberate and systematic planning to occur, teachers must be fully prepared. Putting unprepared teachers in the classroom, as this study found out, is detrimental to student language learning and their content learning.

4.16 Conclusion

This chapter describes how limited English language proficiency, a crucial knowledge base, adversely affected the teaching of science through English. The discussion is based on the analyses of LEP teachers’ language choice and their pedagogic functions, the accuracy of the teachers’ L2 performance, and teachers’ questioning techniques. The next chapter examines what other knowledge bases that LEP teachers have or did not have that influenced their use of English in the science through English classrooms.

CHAPTER 5

DATA ANALYSIS AND FINDINGS: TEACHER KNOWLEDGE BASES

5.0 Introduction

In Chapter 4, the nature of teacher talk by LEP rural science teachers and the extent this affected their teaching of science through English was captured through qualitative and quantitative analyses of the teachers' classroom talk. Adopting the position that the quality of teacher knowledge influences the quality of the teacher in the classroom, this chapter analyses the teacher knowledge bases that underlie LEP teachers' English language use in the teaching of science through English. In so doing, the chapter addresses the research question:

What teacher knowledge bases did the LEP teachers have/did not have that influenced their English language use in the teaching of science through English?

The knowledge bases model for expert teaching by Turner-Bisset (2001) which comprises 12 categories (see Sections 2.5.1 to 2.5.11) was used for this purpose. The analysis will try and determine to what extent the data met the criteria outlined in the framework. Data were primarily obtained through interviews with the three main participants of the study as well as from five other teachers (two science teachers, two Mathematics teachers and the English panel head) and the headmistress from the same school. These interviews were conducted in Malay at the request of the participants. Interview transcripts were then translated into English. Audio recordings of teacher talk by the three main participants of the study, classroom observations of their lessons, and field notes supplemented the interviews.

5.1 Analysis of Data

A web of inter-related factors emerged in the data to reveal the knowledge bases that influenced the teachers' talk in teaching science through English. Although the coalescence of the factors made it difficult to tease them out, the following knowledge bases emerged from the data.

5.2 Knowledge of Self

Knowledge of self is an important component of the teacher knowledge base for the teaching of science through English, the change agenda of the MOE. According to Turner-Bisset (2001) the ability to perceive the need for change is closely related to teachers' emotional engagement such as the feelings they attach to good or bad lessons. This study found that the teachers' emotional engagement was greatly influenced by their English language proficiency. Being limited English proficient made all the teachers very conscious of their inadequacy, making it difficult for them to embrace ETeMS. They recognized that their weak knowledge base of English was a major hurdle that adversely affected their implementation of the policy. They openly acknowledged their English language deficiency and spoke about its effects on their self-confidence. Farina revealed that her initial reaction to ETeMS was one of anxiety. She confessed to have never been interested in English language and was troubled by how this was going to affect her practice:

Extract 5.1T

I am very concerned that I'm really not interested in English (laughs). Throughout my school life I've never passed English but during my SPM I could. Even then it was only with a pass (P7).

However, she did not perceive ETeMS as totally bad. She thought its success depended much on the teacher quality. She acknowledged the fact that teachers like her would

have difficulties delivering science through English as her exposure to the language was limited:

Extract 5.2T

Science in English at primary school is certainly good but it depends on the teacher. But for teachers like me who learned science in Malay it's difficult. Even at college the English we learnt was basic. Suddenly, there's a ruling that science and mathematics is in English. Everybody is shocked and extremely nervous because we're not very exposed to English. But really, the idea is good but it depends on the teacher. If the teacher lacks exposure to English, problems will arise from there.

Ruhani too talked about how speaking fully in English was problematic for her. Moreover, her inability to obtain books for reference on scientific terminologies, according to her, did not help to ease the problem. She also pointed out the shortage of dictionaries:

Extract 5.3T

As for me, it's use of English in general (that's difficult). Furthermore, I need to refer to books for terminology. Although sometimes the books are available, not all of them are the latest editions. We also don't have enough dictionaries. If I want to borrow from the others, they might not be able to lend me theirs as they need to refer to it too.

This revelation regarding inability to secure resource materials was rather surprising. The school had internet connection which could have been used to access many online freeware teaching materials and dictionaries. Having a personal dictionary was crucial for the teachers. The fact that Ruhani spoke about sharing dictionaries also showed that the Ministry had not fulfilled its promise to supply teachers dictionaries which was supposed to be a part of their self-learning package.

Zuleyka, like Farina, admitted being shocked when news of ETeMS was first announced. Her reaction was due to her lack of confidence and the realization of the amount of learning she had to do. She knew she could no longer ignore English like she used to:

Extract 5.4T

In the beginning I was dumbstruck and I was kind of fearful. I was against the idea. I wasn't confident. I feel my problem is that I've a lot more to learn. In the past I was not bothered with English. I still have a problem with grammar.

Zuleyka also revealed how sometimes English words eluded her during delivery:

Extract 5.5T

My problem is speaking in English. I use broken English. Although I have passive knowledge, the words don't appear spontaneously when I teach. At times English words don't surface at all (laughs). Sometimes when I think hard they do come to the fore.

Teaching science through their limited English was truly challenging for the teachers to the extent of causing them to doubt their ability. Farina stated she preferred teaching through Malay as she did not have to suffer self-doubts like she did when teaching through English:

Extract 5.6T

As far as delivery goes, I'm more confident in Malay. I'm prepared to explain a certain topic. There's no worry about whether my explanation is correct as there would be if done in English.

Ruhani mentioned about the longer time required for preparation besides the doubts she had when giving instructions to students:

Extract 5.7T

We can do it in English but it would take time. As we aren't good in English every step in the process of teaching a particular topic has to be prepared beforehand. What do I need to write on the blackboard? If it's Malay it's easy (I just have to rattle off) place the second apparatus, take material A and put it into B...

Zuleyka expressed her doubts through her concern about the quality of the English language used by content teachers' and its effects on students' English language development:

Extract 5.8T

Yes, I do think about it. If I do teach science or mathematics in English, I would only emphasize terminology but won't pay attention to grammar. Sometimes even my own grammar is suspect. When I speak without a care for accuracy I worry about what will happen to their English if they emulate my style.

Conflict is essential to any successful change effort (Evans, 1996; Fullan, 1993a, 1993b,

2001b; Guskey, 1986). Adopting the right attitude therefore is an important prerequisite to deal with conflicts in order to succeed in the science through English classroom. For the teachers in this study, this means willingness to treat ETeMS like a second chance at learning and using the English language. However, the findings show that in spite of the awareness of the need to adopt a new attitude towards English, there was little follow through. During the interview, Zuleyka revealed that besides her students' ability, her own confidence level, and the ease in handling a particular topic, her use of English also depended on her mood:

Extract 5.9T

Depends on the mood of the day. On good days with a good class I use English. That too only if I'm more confident on that day. If that's not the case, it depends on the topic. If it's an easy topic then it's ok especially if it's Year 1 or 2. If it's a topic for Year 4 or 5 I can't do that because the students might not understand.

This suggests that despite acknowledging her shortcomings (see Extract 5.5T), there had not been much deliberation on her teaching problem to drive her to work harder on enhancing her confidence in using English in the science classroom. Her use of English, in her own voice, depended on other factors not related to gains from deliberation on action. According to Turner-Bisset (2001), the ability for teachers to change their classroom practice, or any aspect of it depends on the teachers' ability to see that there is a need for current ways of teaching to be improved.

Cognizance of their limited proficiency in English made the teachers unprepared to write their own instructional materials even after four years of teaching science through English. They were totally dependent on teaching materials prepared by others. Instead of utilizing materials from various sources, all the teachers limited themselves to workbooks provided by local publishers besides teaching materials prescribed by the MOE. This was despite noticing that the materials were lean with respect to verbal contents. By using only locally produced materials the teachers prevented themselves

and their students from exposure to the richness of the English language contained in alternative resources. Naturally, they were not empowered to lead students to learn about science and technology through the diverse sources of information on science written in the English language which is one of the aims of ETeMS.

The findings so far indicate that there were major impediments to the teachers' role as CBI instructors that relate to their attitude which included:

- teaching through English is difficult
- fear of the unfamiliar
- preference for teaching through Malay
- concern about the impact of teachers' English language proficiency on students
- changing their mindset about English is difficult
- the lack of action regarding teaching problems

The review of literature on change has shown that when teachers are reluctant, it takes a principal who is good at leading improvement to spur them to change (Janks & Sethole, 2006). The headmistress in this school tried to play this leading role to a certain degree. Being cognizant of the fact that limited English proficiency had severely affected teachers' sense of efficacy, the headmistress made some effort to assist the teachers by encouraging them to participate in the Project to Improve English in Rural Schools (PIERS). When the school was selected as the base for the project, she made a special request for additional teachers from the school to be allowed to participate. The number of teachers allotted for select schools in the district was between two to three. However, several teachers came to see her and appealed to be exempted from the project. They cited various reasons to explain their unwillingness to participate in PIERS. Most of these reasons were captured in the following explanation provided by Azrina:

Extract 5.10T

When I was nominated for PIERS, I knew that besides tending to my family- my husband and my young kids including my 8-month-old baby; teaching extra classes; looking after my dad as I'm the eldest child; overseeing my child who comes back at weekends from a boarding school and my involvement with Year 6, I certainly wouldn't be able to cope. Even if I wasn't involved with Year 6, I'd still have to go in for extra classes four days a week including Saturdays. So, I went to see the headmistress to plead my case.

Eventually, six mathematics and three science teachers in addition to one English teacher who was also a Senior teacher at the school attended PIERS from January to October 2008. The English teacher citing time constraints as a reason for her inability to fully commit herself later opted to take the conversion course which had lesser contact hours (48 hours instead of the 112 hours of face-to-face sessions). PIERS sessions were held on two afternoons for two different cohorts. The sessions which started at 2.30 p.m. lasted for three hours with a short break in-between. In order to find out more about PIERS and its reception from teachers, permission was requested to observe lessons during the days when I was at the school. On these days, I noted that teachers usually arrived just minutes before the start of a session but rushed off soon after class was dismissed. Also, they rarely initiated conversations with their instructor which would entail interaction in English. It can be concluded that the teachers did not use opportunities available through PIERS to develop their English language skills.

In discussions with the three teachers and their colleagues, ETeMS was often regarded as a problem and in Farina's case it remained a problem until the end. Thus, she could not conceal her elation when ETeMS, the source of her and her students' problem, was eliminated with the policy reversal (see Section 1.14):

Extract 5.11T

Very happy. For myself and for the students who are weak in English. Because I feel I can deliver the science content in an easier manner. I can come up with different activities (on my feet) to explain better the concepts in different science topics and science terminology especially those that are strange sounding; those that we ourselves mispronounce. Many students still don't know concepts. I'm indeed very happy.

Similar sentiments were echoed by Ruhani when asked how she felt about the policy reversal:

Extract 5.12T

Definitely happy. Because I'm at present teaching in a rural area. Not all the students in the rural area get exposure to everything in English. If we can teach in Malay, we don't burden parents or the students.

Clearly, the teachers were unable to treat ETeMS like a second chance to master the English language but rather looked at it as a burden. ETeMS was generally regarded as a problem by the teachers because with the dawn of ETeMS their old ways of going about business were no longer adequate. They longed to teach in Malay and in fact, the analysis of their classroom talk showed they did on many occasions (see Sections 4.2 and 4.5) as ETeMS did not sit well with them and their community. Speaking for themselves they regarded the policy as an obstacle in their work, hence, justifying their feelings. Their comments manifested the attitude of insecure, reluctant and unwilling teachers of science through English who were happier to maintain status quo. In short, they speak of the language of unprepared instructors of CBI.

5.3 Knowledge of Learners: Cognitive

The study found that teachers had good knowledge of their students as evidenced by the details they provided through teacher interviews. In discussing problems in their science lessons, all the teachers mentioned how science through English was also problematic for their students. This knowledge was based on their informal assessment of the students made through their regular contact with them. The teachers believed that their students, in particular the weak ones, preferred learning science through their mother tongue. They also perceived these students as incapable of handling science through English. Farina, for example, regarded her students as victims of ETeMS:

Extract 5.13T

I can say from my past experience that half the class understands and the rest doesn't. Those who don't, are just not only weak in English, they are weak even in Malay. Even if we speak in Malay, they have difficulty grasping ideas. English is for the better classes. But the weakest classes are the victims as even their Malay is weak and we have to teach in English. We have to because the exam questions are in English.

This study found that regardless of the stated aims of ETeMS, Ruhani- just like the others- had established her own language policy based on her assessment of her students' achievement levels. According to her, teachers can teach in English with the best class. However, since students with low IQ can only cope with code-mixed instruction, keeping Malay separate was out of the question. This explains the frequent occurrence of language alternations in the teachers' talk as observed earlier (see Sections 4.2 and 4.5). She also perceived the weak students as unwilling to think:

Extract 5.14T

Students are of different levels. We can use English with the best class. But with the second, third, fourth and fifth classes, we have to still switch to Malay. If it's just one language they can grasp some but not all. IQ also plays a part. They need to think all the time. The weaker classes sometimes are lazy and are not interested in learning.

Similarly, Zuleyka did not think she had achieved ETeMS objectives in all her classes.

She attributed the failure largely to students' under-developed linguistic skills:

Extract 5.15T

I've yet to achieve it because the students themselves haven't mastered reading skills even in Malay. The students deemed clever, in the cleverer group, with these I've achieved it. As I said earlier, those students who have yet to even master Malay, they definitely have poor mastery of English. But it would be ok if these students with a poor mastery of Malay were able to read. If they could read, they can better master English. Actually what determines whether they understand English or not, is their mastery of reading and writing skills. Those who don't understand are usually those who have failed to master reading and writing skills.

These findings are comparable to those reported by Kyeyune (2003). In discussing ways in which instructional talk in English by Ugandan teachers sometimes frustrates students she reported that teachers seemed to take learners' language ability for granted and were quick to blame students' attitudes as the source of any gaps in learning. The many hours spent with students had certainly provided teachers with a rich knowledge

of their students' cognitive abilities. Effective CBI teachers would have found this knowledge useful to guide their instruction in a way that supports learning in the challenging context that students had to deal with. However, this study found that teachers tended to use the knowledge they had of their students as an excuse to justify teachers' non-compliance.

5.4 Knowledge of Learners: Empirical

The teachers' knowledge of what interests their students, their social nature and how contextual factors affected them definitely had a strong influence on the amount of English used in their lessons. Farina stated that her weak students would lose interest if she continued speaking only in English and she would end up doing all the talking. Her students, she claimed, were unwilling to participate if instruction was conducted only through English. She believed they were reluctant to speak because they felt awkward speaking the language:

Extract 5.16T

It affects negatively the weaker students. Interest too has some influence. When I question in English, I need to provide my own answer. They won't speak. They don't want to speak. But when I teach in Malay, they at least respond, they don't feel embarrassed, they aren't shy about speaking, and they are able to speak. Although they may have passive knowledge, they can't respond in English. So they take the attitude it's better to not say anything and just be silent. I can't wait forever so I answer my own question in English.

Ruhani described the silence in response to her speaking in English as follows:

Extract 5.17T

The weaker classes don't respond. They keep quiet, just watching me. (So I tell them) "Give me the answer in Malay. Try." Although their answer is nothing great, it doesn't matter. When writing an answer to a question in English, their answer is just a copying out of the question. They don't answer the question. When asked why they just copied the question for the answer, they explained they didn't understand (the question). That's how they respond to all written questions. But if it's in Malay, they'll attempt to answer.

Zuleyka also spoke about her lack of success in trying to get her students to speak in English. She claimed she always asked students to speak in English but students only

did so sometimes. She talked about their willingness to try only simple tasks and their tendency to give up when challenged:

Extract 5.18T

If instructions are worded simply they'd follow. If not, they keep completely silent (laughs). This year I've got what I reckon are not bottom of the range classes. So I speak in English. But in the past even if I got the weakest class I'd still speak in English. Sometimes the students attempted oral responses but written responses were still problematic. Sometimes even if I spoke in Malay, for example, "Ha cuba beri nama haiwan-haiwan" (Try giving me the names of animals) they still provided answers in English. They don't say burung, they say bird; tiger. They are willing to attempt answers in English as long as it only requires them to give simple answers.

However, Zuleyka also noted that her students had benefited from ETeMS. She, in fact, was impressed by how much the students had learned through ETeMS:

Extract 5.19T

Previously, the students didn't really know science in English that much but now they have internalized certain words like plant-pokok, human-manusia. If they didn't have science in English I don't know if they'd have this (in their English vocabulary core). I don't agree when people say primary level science taught in English isn't appropriate. Having taught science I know how much the students have gained. When I observe my students today they have more knowledge of mathematical terms than I do. I didn't know the English word for fraction for instance, but my students knew. They even knew the word for decimal. I felt sorry that I didn't get a chance to learn maths and science in English. During my time my exposure to English was only through the English language classes. Now the students are getting English even at the primary level for mathematics. (I feel) Now with this (ETeMS) the students' chances of improving English is greater.

Zuleyka's observation was corroborated by notes taken during classroom observations and analysis of lesson transcripts. The following is one of many examples to illustrate this. In this episode, Azri uttered the phrase *naked eyes* to his friend, Haris, in his play with English words. In response, Haris provided the literal translation for the phrase in Malay:

Extract 5.20

Azri: naked eyes naked eyes, Haris
Haris : **mata bogel**
(*naked eyes*)
Azri: naked eyes

The students had learned the phrase from a previous lesson. Being cheeky boys, they were clearly fascinated by its literal meaning especially in relation to the word *naked*. It

is believed that it would be very unlikely for the boys to learn this word at their age had science been taught through Malay and with English only taught as a subject. This is because *naked* is not only a low frequency word but is also considered taboo at this level and therefore, not likely to appear in their English language lessons. Evidently, learning science through English had expanded students' vocabulary. This is a simple example to show that students can learn English while they are learning science through the language if teachers are able to interest and assist them.

Besides the knowledge bases already mentioned, the teachers' knowledge of educational ends also had a strong link with the extent English was used in the classroom and the teachers' effectiveness as change agents.

5.5 Knowledge of Educational Ends

Of the three kinds of educational ends- the legal requirements enshrined in government legislation, the aims of the school, and the aims and values of the teachers- mentioned by Turner-Bisset (2001), the last two aims appeared to influence the teachers' instructional decisions strongly, and, by extension their delivery of science through English. For instance, when the policy makers initiated the change in instructional language for science, one of their goals was to provide opportunities for pupils to use the English language indirectly increasing their proficiency in the language. The teachers, however, did not seem to share this vision. The teachers' goal was to develop students' sight vocabulary but not mastery in English as intended by the policy makers.

Farina reflected:

Extract 5.21T

When giving directives or asking questions I use both languages because I want the students to know English equivalents for the Malay that I use. Then, even if they don't know how to formulate proper sentences in English, they will know important or relevant words in the language.

Ruhani did not think grammar was important when teaching science. When the errors in her lessons were pointed out to her and asked what preparations were made with regards to language, her response was:

Extract 5.22T

Science does not emphasize grammar. Just make sure students get science terminology. That's only what's required.

Her goal obviously was to develop students' familiarity with science concepts in English. Zuleyka too said she did not concern herself much with planning for language development. Her goal was to provide instruction through what was most convenient for her:

Extract 5.23T

I look for relevant worksheets; think about what I want to teach. Sometimes I use ABM (teaching aids). I go through the teaching aid and decide on content to teach. There's no need for concerns about language. It's difficult, there's no time. (Thinking about) Language takes up time.

Another science teacher interviewee, Salmiah, was very candid about her role and purpose in teaching science i.e. teaching to complete the syllabus to prepare students for the next phase:

Extract 5.24T

I want to impart knowledge and I want students to understand and gain that knowledge (of content in the syllabus). Because if I don't complete this, it will be a problem for students. Therefore, the language of instruction isn't important, let them speak (Malay).

The above testimonies clearly indicate that the teachers could not see that if attention is given to language in the science classroom, students would be provided with a powerful support for language development (Kyeyune, 2003). It is believed that the teachers' attitude might have been influenced by their ETeMS trainers. It was reported that there were conflicting beliefs between trainers with content knowledge versus those with language expertise during ETeMS training:

Extract 5.25T

The other day there was a bit of tension. Science has its own terms. The trainer who majored in English and the one who majored in science had differing views on what to emphasize. The science trainer insists you use English for terminology. But the English trainer wants our language to be correct as well. At least they (the students) know the terms such as observation, science process skill, in Malay and in English.

The findings revealed here reflect what Fullan (2001b) described as “lack of clarity” (p. 77). He maintains that the problem of clarity is a major block at the implementation stage if teachers and others are not clear as to what it means in practice. It is believed that this lack of clarity made it easy for the teachers in this study to focus on immediate concerns such as preparing their students for future exams and to help their school achieve its performance target. Unfortunately, the teachers’ foci caused them to go into the self-fulfilling prophecy mode by acting in ways that did not support the new language policy for science. This is evident in Farina’s explanation:

Extract 5.26T

For Year 6 I teach fully in Malay. Even for Year 5 it’s fully in Malay. One reason being my command of English is poor. And then we want to achieve the goal for UPSR. We want to increase the number of students achieving A’s. We want to achieve the school’s performance target. So we (teach in Malay) so that students understand better the science taught and are able to answer questions well during exams. It’s of no consequence because the UPSR questions are bilingual. So, we take matters into our own hands (laughs).

Ruhani admitted to doing the same. She added that measures had been taken to drill the mechanics of answering science examination questions:

Extract 5.27T

We tried all sorts of ways. For instance, we have in place a protocol (providing stems for different question types) on how to answer different types of questions on science in English. Students are told to paste this protocol on their desks. Unfortunately, they are unable even then to choose the appropriate answer. When you want to answer, you just need to copy the stem. After copying you need also to check the contents of the answer.

The following was Zuleyka’s response when asked why difficult terminologies were used during lessons when students did not even have mastery of simple English words:

Extract 5.28T

The textbook only has content. (The term) manipulative variable is not in the textbook. It’s at the UPSR level. It only appears in the UPSR exam. If, let’s say there’s no UPSR there won’t be (the term) manipulative variable. The problem is there is the UPSR. So, sometimes even if it’s for just 1 hour we

need to teach the topic in the textbook. Once we have technically covered the topic in the textbook, we have to teach for UPSR.

Preparing students for UPSR, the government examination at the end of Year 6, as seen through these comments is an important agenda for Zuleyka and her colleagues. This is because examinations are very important in this country's educational system as they represent the achievement of the child. At the primary level, the UPSR results are often used as the criteria for entry qualification into elite government boarding schools. Additionally, the key performance index for all schools is their performance in public examinations. Thus, it was no surprise when Ayesha, a senior science teacher, made the following confession about her goal for teaching science:

Extract 5.29T

(Laughs) Mostly just for exams. At this level it's just for UPSR. Whatever be the case, the students should have been taught the entire syllabus by the time of the UPSR. We have to (complete the syllabus). If it is not completed we have to work day and night in order to get the students ready. Once the syllabus is completed we do revision and hope they obtain A's in the UPSR (laughs). Even if they don't manage A's, at least passes for the weaker classes. That's just it. If we want to do it the right way it takes up lots of time. First do the theory bit in class. Then take them to the lab to do experiments blah blah. So, we feel satisfied. But at this point we are racing against time- with completing the syllabus, equipping students with the science process skills, revising varied topics of the Year 4 and 5 level, so we rush round in all directions. We can take it that UPSR is a burden.

It appeared that this fashioning of instruction towards examination was endemic among teachers in the area. This was revealed by Farina:

Extract 5.30T

I heard from friends who teach in schools that have achieved targets; that many of the students passed because they teach their classes in Malay. I think people at the Ministry think ETeMS is a success because they just see that the maths and science grades are improving. But do they know if students answered the UPSR in English or in Malay? The questions are set in both languages after all.

I also learned that in this school even the workshops organized were focused on improving student performance on examinations:

Extract 5.31T

The Science Panel Head organized a workshop in the computer lab where we were put into groups. Someone with some expertise like expertise in techniques of answering Section B was chosen. Every time the exam comes round we meet again. We discuss the reasons why students are unable to answer the questions. (Like this class) There are many students who don't do well in Section B. We revisit our weaknesses.

The preceding findings revealed further tension between the goals of the new science curriculum and the teachers' practices. The teachers did not reveal a deep understanding of the aims of the curriculum or their role as CBI teachers and so had interpreted it in an oversimplified way. In this regard, these teachers are similar to those in another study on ETeMS teachers in Tan (2011). In her study of secondary mathematics and science teachers' implementation of ETeMS, Tan reported: "Curricular and exam pressures, coupled with time constraints, contributed to teachers adopting practices that were time efficient but that restricted opportunities for student language production" (p. 336). This in itself was sufficient to reduce teachers' effectiveness in the CBI classroom.

5.6 Knowledge of Educational Contexts

Another prominent influence on the teachers' English language use in teaching science through English was the knowledge they had of educational contexts. It is widely acknowledged that the contexts within which teachers work have a significant impact on teaching performance (Fullan, 2001b; Hiebert et al., 2002; Turner-Bisset, 2001). All the teachers revealed a strong knowledge of their educational contexts especially with regards to aspects related to the school. This was evidenced by the subjects they mentioned pertaining to their living reality: undue attention to examinations, heavy teaching load, non-academic duties, teaching in a rural context, indecisions over ETeMS, lack of preparation and the school infra-structure.

5.6.1 Undue Attention to Examinations

One often mentioned aspect of knowledge of educational contexts was the school and the wider society's preoccupation with examinations. This was best summarized by Ayesha who explained why teachers in the school centred their work on examinations:

Extract 5.32T

Sometimes we ask ourselves how many students who were expected to score A's only managed a C. We constantly provide such information. In order to cover (the syllabus) we are forced to cram all of the content into the students' heads. But job satisfaction is poor probably the students feel the same way.

Exam-oriented instruction led the teachers in this school to make their own language policy when dealing with their students. Ruhani and Farina openly confessed to teaching mostly in Malay (see Extracts 5.14T and 5.26T) if students were weak in order to help the school achieve its performance target. Although the use of Malay for teaching was made on their own volition, the headmistress appeared to support this move:

Extract 5.33T

These days we definitely teach completely in Malay especially if students are weak. We got the consent of the headmistress to do this. She cautioned us to use our discretion probably because she didn't want us to jeopardize the government exam (UPSR) results.

Through conversations with the headmistress, it became clear that academic excellence to her meant the school's ability to produce students who could score A's. This is understandable as the local mass media have an obsession with exam results and their statistics. High scorers and their associated schools are given prominence with each announcement of government examination results. Unfortunately, teachers and school heads are also judged by their students' performance. Understandably, with so much attention and weight given to exam performance, this school head would want to be among the top.

The pursuit of "academic excellence" drove the headmistress to encourage after-school classes for subjects like mathematics, science and English. This put a strain on the ETeMS teachers who were already struggling to deliver their lessons during school hours because of their heavy teaching load.

5.6.2 Heavy Teaching Load

At the time of data collection, the school was facing a shortage of English and science teachers. Requests had been made for additional teachers but were turned down. Teacher allocation, it seemed, is based on student-teacher ratio and not on needs basis; apparently the school had met the ratio. This shortage had certainly affected the work of some teachers in the school, including the ETeMS teachers. Zuleyka and two other science teachers, for example, were assigned to teach English classes:

Extract 5.34T

At present we have a shortage of English teachers. But we can't really blame the school management as all postings are determined by the Ministry. They should know the number of English teachers required for a school with twenty nine classes. But they are not sensitive to this. So, teachers with a slightly better proficiency in English are asked to fill in temporarily. Often this temporary measure could go on for years. She (referring to her friend) is a Malay major but has been asked to teach English because of the shortage. Sometimes it burdens the teachers too but rather than having no English teacher in a class in essence it is better for the students to get some English. Even if the students gain only 50% of what they should be getting, it's better than nothing at all. But job satisfaction is often poor.

The teachers were affected even more when a major school renovation started in 2009. Among others, two single-storey structures which used to house the lower primary students were demolished to make way for the construction of a newer and better building to accommodate a growing population. To cope with the shortage of classrooms the school session was split into two. Teachers were divided into three groups. One group taught in the morning and the other in the afternoon session. The third, fondly referred to as *cik gu dua alam* (amphibious teachers) by their colleagues, taught both the lower primary and upper primary levels. Zuleyka was in this pool. The shortage of teachers did not permit a clear demarcation in the division of teachers to serve the two sessions. In a compromise between the school management and the third group of teachers, it was agreed that time-tabling be adjusted in a way that allowed these teachers some hours off in the early and later parts of the school day. Although the adjustments enabled instruction to proceed uninterrupted, the shortage of teachers

remained a problem. This meant that science teachers had to teach more science classes (see Section 3.2, Table 3.1) thus, making serious preparation for lessons an even more remote possibility.

In general, the ETeMS teachers in this school had heavier workloads than their colleagues who taught other subjects. They had to do the work that all teachers were expected to do and in addition teach extra classes after school. The teachers admitted the extra classes had put a lot of strain on them. Azrina, a mathematics teacher, lamented the load she had to bear:

Extract 5.35T

If there are holidays in May, August or March, they are, in essence, non holidays. If we teach Year 6, we have to come back for classes, we even have night classes. Sometimes we feel really stressed. But I guess that's our challenge. That's our fate. We have to do it.

Her colleague, Joni, shared those feelings and was more explicit in her illustration of her routine as a teacher:

Extract 5.36T

On Mondays I have classes from morning to the afternoon, sometimes there are meetings too, added to which are the tuition classes. Sometimes when a teacher is unable to go to class and I happen to be free I'm forced to go into that class. On Wednesdays I'm involved in co-curricular activities. If I don't have co-curricular activities on a particular Wednesday I have to go into a Year 6 extra help class, an intensive class. Every term break, as long as the exam is not over, the extra classes go on. If there are teachers who go back (during the break) to their hometowns which are far away, then we have to take over their classes. Those of us, who live in the vicinity of the school, like it or not, get picked. That's very tiresome.

Fatigue, stress, and tension are common themes in conversations with the teachers.

5.6.3 Non-academic Duties

All the teachers complained about non-academic duties robbing them of their free time. These duties stemmed from three sources: undue importance placed on school appearance, participation in competitions and clerical work.

5.6.3.1 Undue Importance Placed on School Appearance

The school image was very important to the headmistress. The colourful buildings and labelled objects would immediately strike any visitor to the school. Buntings with printed words of wisdom lined the walkways. Classrooms were decorated with enormous amount of teacher-prepared posters and several classroom windows were adorned with fancy curtains. Some of which were sewn by the teachers. All these took many man-hours from the teachers and needless to say made them rather unhappy. Farina was the most vocal critic of the school's obsession with appearance. She loathed the amount of time she and the others had to spend on putting up posters, painting murals and making a rock garden. She described how all these and trying to manage pastoral duties and keep up with marking harried the teachers. She was sorry that the job specification for teachers was so broad:

Extract 5.37T

When we're ready to paste (the posters) some sections weren't ready. We had to work on the research room, the big room and galleries which were everywhere. We had to paint and add murals here there and everywhere. Yes, it's for the good of the school image, but it can be burdensome. This evening I've got to come back to finish up here. When it's sports season, we need to go for sports practice. Go home for a short break and then come back for this. Then send the students there. Those of us who handle sports need to send the sportsmen too and then hurry back to class. So, our concentration is always dissipated. Actually a lot of our time...When I look at the office workers, they concentrate on just office work. They don't go out to do various other activities. They are not involved in landscaping or creating a rock garden. We teachers are not like them. We aren't just teachers! Sometimes we take books home to correct and we do this late into the night. So, our job doesn't stop once school ends in the afternoon. In addition to involvement in sports, there are club responsibilities too. Each teacher is responsible for one sports activity, one club, and has to be a class teacher.

5.6.3.2 Participation in Competitions

Some of the non-academic duties the teachers shouldered were the result of the school's frequent participation in competitions. During the duration of data collection (between April 2008 to May 2009), the school participated in a *boria* competition, a singing competition, staff room competition and one that was quite major involving every teacher in school, the School Resource Centre competition. According to the teachers,

their school participations in some of the competitions were decided by the State Education Department. While Farina, Ruhani and Zuleyka were more guarded in expressing their frustrations with the amount of non-academic work that teachers had to do, their colleague, Joni, was less so. She resented the school's participation in competitions which she perceived caused teachers to pay less attention to teaching. She was also displeased with the school's inability to reason with the Department of Education for an exemption from participating in competitions:

Extract 5.38T

So we get involved in competitions such as this. Teaching is relegated to second place. What's happening now is that all the classes are empty. Where are the teachers? Out there painting different places and hanging up posters everywhere. In my view, we should not enter competitions such as these. I don't care if the school doesn't get a name. What's important is that the students learn. That's my opinion. I met with the headmistress and told her how I felt. It's ok if we enter a competition and we teachers are willing to work extra hard. But there should be some planning. It shouldn't be that we do all the preparation the same year as the competition. She (the headmistress) explained that it wasn't her doing. It's a problem created by the Department. The Department came to the school and asked us to enter. Yes, but who is the Department? They are people too. Why don't we forward our views to them?

5.6.3.3 Clerical Work

There was also a lot of contention about the amount of clerical work teachers had to do.

Farina gave a glimpse of what teachers had to put with:

Extract 5.39T

It's ok if the teacher's sole duty is to concentrate on teaching and learning...and that's how it should be. But we are burdened with so many other responsibilities. All these interfere with our work. We have lots of clerical work to do. We need, for example, to prepare handwritten copies of namelists all year long. They're required at different points in time by every division of the Student Affairs section.

5.6.4 Teaching in a Rural Context

In addition to the aspects of contextual knowledge already discussed, the teachers' knowledge of life in a rural area also made them pessimistic about CBI. They had a conception that learning science through English was not advisable for their students. They mentioned their students' lack of exposure and limited opportunities for out-of-school assistance as two major hurdles. According to Uys et al., (2007) it is not

uncommon for teachers to generate their own educational theories. In explaining her preference for using Malay, Ruhani explained exposure to English was limited in the community outside the school. In her opinion it was better to teach in a language that everybody could understand:

Extract 5.40T

Because now I teach in a rural area. Not all rural students have a lot of exposure to English. So it's easier for me to teach in Malay. In this way parents are not burdened, neither are the students.

Salmiah believed students lacked interest in English partly because they did not get any reinforcement at home. She explained parents were unable to motivate their children since they themselves were deficient in English. She pointed out that rural students do not attend as much tuition classes as their urban counterparts:

Extract 5.41T

How can they be interested? When they ask mum at home she doesn't know. So, it's just put away and as a result they aren't motivated. But I feel, as far as the urban children are concerned, the objective can be realized. This is because the majority of the students are used to tuition. There are lots of tuition opportunities out there. So, they are used to English. In the rural areas it can be achieved but it would take a long time.

Zuleyka, however, believed that what they were experiencing was normal in a change process. She hypothesized that if the ETeMS policy were to remain, future parents would not be as helpless as the current ones should their children seek their help:

Extract 5.42T

In the beginning it was difficult but as time went by we became accustomed to it. At present, the kids' parents speak Malay and so are unable to help them. But when these kids become parents themselves they wouldn't have problems helping their kids with English. We can achieve targets to some extent but not 100%. This is because we can't just depend on teachers. The kids need to study both in a formal and in an informal manner the whole day long.

5.6.5 Indecisions over ETeMS

Indecisions about ETeMS certainly did not help to keep teachers motivated. Farina, for instance, was influenced by a rumour she heard over the radio which speculated the fate of the policy:

Extract 5.43T

Recently, I heard over the radio that PPSMI may be retained on condition that the medium of instruction is both Malay and English. That means there's some flexibility. As there's this flexibility, I feel it's not wrong to use Malay in classes that can't handle English.

Indecisions also came in the form of conflicting directives from the State Education Office which teachers found confusing. Ruhani admitted not knowing who to listen to when directives were inconsistent:

Extract 5.44T

The State Education Department is unsure as well. Sometimes it's one language and at others, two. Mrs. R, the latest addition to the staff, doesn't want us to mix languages. She wants us to stick to one language for teaching purposes. But according to a circular we received, you are allowed to use both. According to another circular from the State Education Department the exam questions will be in two languages. But Mrs. R is adamant. At present the students are more adept at Malay. Hence, their understanding is better in Malay but questions are in both languages. That's why students preferred choice is Malay. If you are really serious about English then teaching and examinations should only be in English. Then it's all very clear and transparent.

Zuleyka revealed her disappointment with the Minister of Education for wavering in his decision about language choice for assessment. She expressed a need for a firm decision to encourage teachers to take the new language policy for teaching science seriously and to remain committed:

Extract 5.45T

In the beginning Hishamuddin (Education Minister) announced that everything would be in English but suddenly midstream there has been a change. Both languages are allowed now. Therefore, we feel that if we use all English the students are at the losing end. But if we go completely Malay, the students, when they advance to higher levels, will know no English to be able to cope. We are in a quandary. If they are really serious, there should be commitment to whatever language that has been decided. If they say it's everything in English then we can force ourselves to abide by this. Indecision like this is very unsettling. If they are serious about Malay, then it should be that all the way.

It is evident from these voices of teachers that indecision is very disruptive. The teachers' comments corroborate the observation made by Fullan (2001b) that "clarity (about goals and means) is a perennial problem in the change process" (p. 76).

5.6.6 Lack of Preparation

All the teachers were aware of the importance of being prepared for teaching. However, observations showed that the teachers always entered the class under-prepared. The teachers confirmed this and cited three main reasons: time-tabling, lack of time and teachers' personal life.

5.6.6.1 Time Tabling

As pointed out earlier (see Section 3.2: Table 3.1), the teachers taught many different subjects and cohorts. The variety came with the need to juggle varied demands. This was very hard for the teachers. Zuleyka explained the dilemma teachers faced:

Extract 5.46T

Nowadays, my preparation for teaching is nowhere near complete. Sometimes I don't just teach one level. In one given day I may teach Years 6, 4, 3 and 1. I'm probably ready for two classes. The other two...it's like this every day...we are only human. Sometimes I don't teach just one subject. For instance, if I teach two Year 5 science classes, then setting up the apparatus becomes worthwhile. But that's not the case. We flit from one class to another. As a human being this all seems so illogical. Today it's possible to prepare for the next day, thinking this topic for Year 3, that for Year 4 and that for Year 6. But to do this everyday...We have good intentions. Ok for the topic Micro-organisms I'd like to set up a sample, use the CD to show them examples instead of just having them look at pictures. I'd like to use different resources to make learning more interesting but time doesn't permit this. Sometimes I prepare into the night yet all is not done. But if we are asked to specialize in teaching a certain level, then all our time and energy can be more focused. For instance, if I'm asked to just teach say Year 3 on the topic "external features of plants and animals" then I could focus on just that. It probably would work out. It's possible for me to prepare different worksheets with different samples. But to do this under the present condition and to do it all in English... I'm forced to prioritize.

5.6.6.2 Lack of Time

Time was a rare commodity for the teachers. All of them reported not having much time for planning their instruction. Ruhani said it was difficult for teachers like them to plan early as their attention was often divided due to the nature of their work. She perceived planning for instruction as an activity done during teacher training when teachers have less responsibilities:

Extract 5.47T

It's difficult to plan early. If it's like those practicum days before, planning ahead is possible. I had nothing else to do. But now, whatever free time I have I spend doing this that and the other. There's no time for planning for teaching.

Zuleyka disclosed that she hardly planned for teaching these days. The distractions resulting from the school's participation in competitions, she said, left very little energy and will to concentrate on planning. She revealed that her preparation was always carried out at the last minute as she was unable to cope:

Extract 5.48T

In my view, up until the year before last when this school did not participate in any competition, the teachers were all still calm. They were prepared for classes. I was prepared too. But this year I'm never prepared, I don't have the energy or the will to prepare. I (only have time) get to look at the lesson I need to teach on the day it needs to be taught. Where's the time for preparation?

5.6.6.3 Teachers' Personal Life

If teachers could not do much in school, home was no better. Free time was also scarce there. For example, Farina who had three young children spent her time at home mainly playing her role as a mother. This was true for Ruhani and Zuleyka too. This made it quite difficult to do any school work. In Farina's case, that possibility was not even an option as her spouse expects her to devote all her time to family matters when she is at home:

Extract 5.49T

Time for preparation is limited. Time at home is spent on the family. My husband doesn't like me bringing school work home. I also have three young children to tend to. The situation at my homefront doesn't allow for preparation at home. It's probably not the same for everyone. Even if I go home in the afternoon and my husband returns home only in the evening that doesn't mean I can relax. I need to do all the housework: washing, cooking. I need also to send my children for religious classes. Time for preparation is really limited.

She talked about "stealing" time to cope:

Extract 5.50T

We can't really say there's no time at all. That's lying, right? We need to be clever at "stealing" time. We can't say we don't have time. That's telling a lie, right? I think I have to "steal" time and manage the time that I have.

Teachers going to class unprepared and having to steal time to prepare for lessons are a sad reflection on our school system. All will agree that if teachers are to be successful at teaching science through English, they must prepare themselves for it. Although it does not follow that by preparing their lessons they would be able to become effective teachers for teaching science through English, their failure to prepare certainly prepared them to fail in learning to become effective. Preparing well for lessons is especially important for the teachers in this study and it would help them considerably since they were already disadvantaged at the outset by their limited knowledge base of English.

5.6.7 The School Infra-structure

It was reported that the MOE spent close to RM5billion on the ETeMS project buying 36,197 laptops, 9,532 printers, 23,228 LCDs, 27,957 screens and 33,667 trolleys (Alis, 2006). The Ministry was certainly generous in its allocation of funds for ETeMS but the important question is, was the money well-spent? It was discovered that in this school it was not. Out of 40 desktop computers available at the computer lab, only four were functioning. It appeared that no scheduled maintenance had been arranged. Ayesha revealed:

Extract 5.51T

Sometimes we are only able to use 10 out of the 40 computers available. So maintenance schedules have to be improved. What's the purpose of having something that can't be used? Sometimes when we take a class of 40 students to the computer lab only 10 computers are in working order. What then are we expected to do? Sometimes it's easier not to take the students at all (laughs) if only 10 computers are available. Don't know what the other 30 would be doing. It's really problematic. Maintenance is really important. The computers have been bust for a year or two now. We have the computers so the maintenance division has to monitor and do the repairs. (She was corrected and told there were just 4 or 5 working). It has come down to just 4 or 5? The computers have a high usage rate so maintenance is imperative. There should be monthly checks to see which are in working and which are not. Each school has this hardware and it has to be maintained. Perhaps, the district should have a centre for maintenance.

Zuleyka explained how the shortage of computers had affected her work:

Extract 5.52T

In our school there isn't any computer in the classrooms and this is a problem. So I take them to the computer lab at least once a week. We need to use the courseware provided. But we are able to achieve very little because of the shortage of hardware.

It was noted that the laptops provided by the Ministry were mostly used for word processing as teachers in the main were not computer savvy. Many teachers were still unfamiliar with e-mails and the use of the internet was not second nature to most. The Ministry's vision of teachers networking through ICT or surfing to retrieve information therefore appears to be a vision difficult to realize. For those who were computer literate, they were often discouraged by slow internet connection or, as revealed by Zuleyka, frequent blackouts:

Extract 5.53T

There are also technical problems. Last year, I used to quite often take the students to the computer lab but this year we have had frequent power failures. Sometimes the air conditioners give trouble. When they are switched on, the computers shut down. We are always faced with such problems. We have no objections to taking students to the computer lab. In fact, the students enjoy it; it's something away from the normal routine of just doing exercises. They like the change.

As revealed above when ICT was used in the science classroom, it was only useful to break the monotony of routine or to enhance the fun factor in learning but nothing was mentioned of enriching language use.

With regard to LCDs, only the computer lab had a functioning system. The ones which were earmarked for classrooms were not used as installation was incomplete. Some classrooms were missing either the projector or the screen or the speakers. Ayesha described the situation as follows:

Extract 5.54T

The problem is this: the LCDs are fixed in one place and the screens somewhere else. Sometimes we have the LCD but no screen...the screen has been taken to some place (God knows where). When there's no screen, we should take from the classroom that has one (but missing other components). But that's the job of the management. Actually, the LCDs (in the classrooms) have never been used.

Ruhani added:

Extract 5.55T

But there are classes where it (LCD) can't be fixed. Like that class for instance, I tried but I couldn't use it. This class however has everything in place.

Letters sent to the authorities to highlight the problems had seen no result. Consequently, the odd LCD components which were fixed in the classrooms became white elephants and teachers continued to deliver chalk and talk lessons. In any case, it is believed that the classrooms which had large glass windows were not conducive for LCD use. The windows allowed too much light into the classrooms and the glare would have made visibility poor.

Other educational teaching hardware available at the school was also under-utilised. The building where the Year Four, Five and Six classes were located with its multi-storey structure made the transportation of teaching hardware difficult. Since primary schools have short teaching periods and do not hire technical assistants, teachers considered lugging the hardware cumbersome.

Based on the observations above, it appears that the MOE would have been better off spending money buying simpler and inexpensive teaching materials or hiring the much needed assistant instead of focusing on computers and LCDs. The science room in this school was lacking in many ways. There was only one retort stand and one piece of spring available for use during an experiment in one of the classes observed. The lesson on *circuit*, although it was held in the science room, did not include any of the suggested experiments as the room was not equipped with the necessary materials. Although the teacher, Ruhani, had directed students to relocate to the science room, it was just a change of scene with nothing different in the conduct of the lesson. The shortage of teaching aids affected instruction particularly when it involved weak students. The shortage coupled with the absence of an assistant to help teachers cope

with preparation meant that weak students were not assisted in their learning as revealed by Ayesha:

Extract 5.56T

A shortage of teaching aids is a problem. The weaker classes have a need for a lot of teaching aids. Labs should be fully stocked in primary schools. We don't have any lab assistants. It's best that we do as teachers have a lot to do in a primary school. They don't just teach. Like our school for instance we enter all kinds of competitions. Where's the time to prepare teaching aids. Furthermore, teachers aren't around, in the afternoons there are meetings to attend or cooperative activities to look into. Where's the time to prepare teaching aids?

Zuleyka shared similar sentiments and pointed out that science rooms at primary schools should be well-stocked just like the science labs at secondary schools. In fact, she argued that the science rooms in primary schools should be upgraded to science labs in tandem with the new, high-level syllabus. In addition, she highlighted the difficulty of gaining access to the science room to set up activities early because other teachers might need to use the room:

Extract 5.57T

I feel there isn't enough stock (materials) for teaching. The (science) room, for instance, isn't well stocked. When we require something for teaching, things are not there (laughs). The primary school science rooms aren't well stocked like those in secondary schools. Actually the science rooms should in fact be fully equipped as our syllabus is of a high level. I also think that science rooms are no longer relevant in primary schools. We should have science labs instead. Even so the problem remains for preparation. There's no time. We have so many classes to teach. Even if we can prepare ahead for the next day's class another teacher may have to use the room before that.

It is well-established that comprehension is enhanced if teachers present content visually to contextualize input for learners learning content through a second language (Cummins, 2001; Gibbons, 2002; Peterson, 1997). The revelation that these teachers were unable to do this very much suggests that they were not always able to make their lessons accessible to their students who were said to be reluctant to learn through English. This might just reinforce students' perception that learning through English is difficult and thus, perpetuate their reluctance to learn through the language. Furthermore, it would be a challenge for teachers to shift their practice towards

providing students with active learning experiences as recommended by the curriculum without the necessary tools.

In addition to comments about the science room, Zuleyka also raised the issue relating to lab assistants in primary schools. She provided a convincing argument for hiring lab assistants in primary schools by pointing out the challenges teachers faced working alone with their young charges. She touched on problems in monitoring students during science activities and her concern about their safety:

Extract 5.58T

In addition to the existing problems with science rooms, there's the matter of control. Unlike in the secondary school where students are old enough to take care of themselves, the case is different with young primary school kids who are unaware of danger. This is why we need lab assistants. Sometimes these kids get excited about what's going on in the lab (read science room) forgetting that it could be dangerous. We are troubled by this. There are sharp objects. Kids like to poke each other in play. We are worried about safety under our watch. Yes, we do give instructions about what should be done. Most are compliant but there is the odd recalcitrant. With 40 kids under our watch how can we stay focused? Especially so during group work activities when the teacher needs to move from one group to another trouble may be lurking in some group. The lab assistant would be another pair of watchful eyes.

5.7 Beliefs about the Subject

Based on the input from the participants, two beliefs related to science emerged as factors which influenced their teaching practices in the science classroom. The teachers had a definite view of teaching and learning of science. They also believed that science is a language.

5.7.1 Teaching and Learning of Science

The teachers appeared to subscribe to different beliefs about how science should be taught and learned. Farina said that science requires memorizing scientific concepts and facts. Researchers (Yoon & Onchwari, 2006) had written that this line of thinking is ubiquitous among many teachers.

Extract 5.59T

(How) Science should be taught...through memorization- summaries of concepts...concepts should be memorized, like memorizing the multiplication table. Next, is reading and referencing. Notes should be in the form of mind maps. There's no necessity for copious notes, just the important words. I have to give them more practice exercises, which reflect exam questions. Notes in mind map form, memorization of facts...teaching that includes repetition- when an answer is incorrect repeat the correct answer many times. Repetition, God willing, will help them remember.

Farina's belief is far removed from the MOE's belief that learning science requires active participation (see Section 1.6). Observations and transcripts of her teacher talk confirmed that Farina's practice was closely aligned with her belief. Her lessons were still conducted in ways that aligned with behaviourist methods with emphasis on rote learning and drills. For instance, because all the students scored zero for the questions on *variables* on their tests, Farina penalized them by making them write the correct answers ten times. Worse still, the students were not required to copy the questions. She also promised to test students on the same questions later, and warned that the penalty would be to write out the answers twenty times should they fail again. However, to be fair on her she also incorporated activities for her students albeit with room for improvement.

On the other hand, Zuleyka and Ruhani appeared to have an awareness of today's definition of science education. Zuleyka understood the need for increasing student involvement and minimizing transmission. She also knew the value of moving beyond textbooks:

Extract 5.60T

Lots of hands-on activities. Not just teacher talk. There should be more student participation-type activities. After their practicals, students should do further related activities. If there is some computer software, that's even better as it has graphics. The advantage of the software is its visual capacity, its colour. This arouses the interest of the students.

Similarly, Ruhani knew the importance of engaging students in experiments and working in groups. She also saw the role of teachers as facilitators:

Extract 5.61T

In my view, teaching of science, if we follow the past methods, should involve carrying out experiments. Students should do them in groups with the teacher playing the role of facilitator. If left at the theory level students definitely won't understand. It has to be made concrete visually. This will arouse their interest. They'll want to try and hence, they'll understand better. In the past, when we used Malay we could come up with varied activities easily.

Although they were enlightened in their knowledge about current views on education, it is clear from their statements that Zuleyka and Ruhani were mainly emphasizing content learning and getting students interested. Group work was meant to reinforce understanding of content while softwares were valued for their aesthetic appeal. Nothing was mentioned about supporting students' language use or growth. Advocates of CBI believe that integrating content and language learning enables students to reach high levels of L2 than by conventional L2 classes (Cammarata, 2010; Murphey, 1997). In order to achieve this, however, requires teachers to plan activities that compel students to talk. This talk according to Farrugia (2003), would consist of a mix between everyday words and the subject specific or technical words. Classroom observations and interviews indicate that teachers were unable to provide this learning situation in their science lessons. In this regard, the findings from this study are comparable to those highlighted in previous research (Sophia et al., 2010; Tan, 2011) where teachers were responsible to balance two instructional goals simultaneously: to develop mastery of content and the learning of language but were unable to do so.

It was noted that teachers were not very good at applying their beliefs about science to practice. Ruhani incorporated group work in some of the lessons observed. However, she seldom specified the time limit resulting in lessons with no proper closure. Group work was unnecessarily extended by adding more tasks for students to complete or asking students to copy things already in the textbook. There was also too much drawing and colouring during her lessons. Zuleyka tried to make abstract concepts real for her students through the use of realia. However, her preparation was sometimes

insufficient. For example, in teaching the concepts *transparent*, *translucent* and *opaque* she only had one sample of each. With her cursory explanation students were still unable to grasp the concepts even in the second lesson as shown below:

Extract 5.62

1. Zuleyka |transparent **apa?**|
What is transparent?
2. |**cik gu dah beri contoh ha** |
Teacher gave you the example ha
3. |transparent **apa dia** transparent?|
Transparent what is transparent?
4. |**bagi contoh** |
Give an example
5. |give example {materiaaal} (0.2) aaa transparent material|
6. Zuleyka |transparent **apa?**|
What is transparent?
7. |**cik gu dah beri contoh ha** |
Teacher gave you the example ha
8. |transparent **apa dia** transparent?|
Transparent what is transparent?
9. |**bagi contoh** |
Give an example
10. |give example {materiaaal} (0.2) aaa transparent material|
11. |**haa bagi {apa dia} bagi contoh** transparent material|
Haa give an example of a transparent material
12. |**semalam cik gu dah bagi contoh dah** three examples or type material
/transluʃən/ dengan /ɔpek/ ha?
Yesterday, teacher gave you three examples or types of materials that are translucent, opaque ha?
13. Rokiah metal
14. Zuleyka |**apa dia** metaaal?|
Did you say metal?
15. |**mana metal** transpareeent|
How can metal be transparent?
16. |**semalam cik gu dah beri contoh dah**|
I gave you the example yesterday
17. |**semalam contoh benda apa yang** transparent?|
What was the example for transparent yesterday?
18. |**apa benda yang** transparent?|
What was the thing that was transparent?
19. |**atas meja semalam satu** transpareeent **satu** /transluʃən/ **satu** /ɔpek/ (0.3)
aaa object
On the table yesterday was one transparent (object) one opaque (0.3) aaa object
20. |**buka lah buku teeeks**| (showing annoyance at the students)
For heaven's sake look at your textbook
21. |**semalam kan dah belajaaar apa** transparent?|
Didn't (we) learn what transparent means yesterday?
22. Amir transparent **tu apa?** (asking his friend)
What is (the meaning of) transparent?

The findings suggest that there is a need for teachers to shift their instructional practices in a way that is consistent with current theories of learning science in the CBI classroom.

5.7.2 The Language of Science

The study found that teachers intuitively knew that the language of science is precise and concise. This, in their perception, made the teaching and learning of science through English even more challenging. In this way, they were referring to Cummins' (2001) theory about Cognitive Academic Language Proficiency. Farina highlighted how Malay is more verbose in contrast to the compact scientific terminologies in English:

Extract 5.63T

We need two sentences in Malay to get at the meaning of a term. When they answer a question in Section B in English their answer may be short but it's concise. In Malay the answer is long (and probably not quite accurate).

Zuleyka's reflection on the difficulty of focusing on language accuracy, science process skills and science concepts simultaneously illustrates the challenges facing teachers teaching through a "weaker" language.

Extract 5.64T

(Teaching) Science is a problem. We need to be watchful, all at once, about our language, about developing science process skills and about expounding science concepts.

Zuleyka concluded that for students to achieve success in learning science, it was pivotal to have good mastery of English language skills:

Extract 5.65T

In Malay, a student's answer involves writing a full sentence. However, with English just two words gains them full marks. For those students who are generally weak in languages, mastering English is their only option. The problem for those who can't master English is that they don't understand what they read.

There is truth in what the teachers had observed. Unfortunately, little time was spent on gaining mastery in English or the science register in the classroom due to teachers' own limited English or their lack of knowledge in language pedagogy.

5.8 Knowledge or Models of Teaching

The study found that the models of teaching teachers based their instruction on which very often were closely linked to their beliefs about science greatly influenced the quality of their English language use. Farina's model of teaching was clearly associated with the behaviorist theory where emphasis was on repetition and rote. Students were frequently drilled and instructed to memorize and copy information. In contrast, Ruhani appeared to subscribe to the model of teaching that emphasized fun. Her idea of achieving fun was to ask students to do a lot of drawing and colouring. Unfortunately, by focusing on fun she neglected the core business of teaching that is engaging students in the discourse of science. Much of the work students did in her lessons kept them busy but contributed little to their learning of science or the development of English language skills to talk about science. The discussion portion of her lessons was often rushed and in some cases, the class was never brought together to examine the activities done.

Although Zuleyka talked about the importance of increasing student involvement and minimizing transmission (see Extract 5.60T), in practice, her model of teaching appeared to be based on a model of learning as simple recall and conditioning. Her questioning strategy which adhered to the IRF pattern also reflected the teaching model she subscribed to. In her lesson on *magnets*, for example, through the use of repetitive sentences accompanied by demonstrations using magnets, she was able to make concepts such as *repel* and *attract* become part of the students' schema (see Extract 4.84). However, it was also noted that excessive repetitions and use of the IRF led to boredom causing students to disengage themselves from her lessons.

The teachers had been assiduous in modelling English pronunciation by requesting students to repeat after them. Farina reported making copies of written materials on

science for students and using them for teacher-led reading aloud activities. She also took the opportunity to translate difficult English words into Malay while doing that:

Extract 5.66T

So I make photocopies and read along with them. I read aloud and they repeat after me. I explain difficult words, often through translation, as we go along.

Reading after the teacher happened frequently when a lesson involved the use of written texts. Sadly though, on many occasions the quality of modelling could have been better. For instance, Farina's pronunciation of *variable* was baffling initially as it sounded like *by robot*. It was only after following her lesson closely that the intended word became apparent. Equally confusing was Ruhani's pronunciation of the word *circuit* which she repeatedly uttered as either [skət] or [səkət]. Operating based on gut feeling, the teachers could only "guesstimate" and often modelled wrong pronunciations for their students (see Section 4.8.5). With topics spread over a few days, these mispronunciations quickly became deeply ingrained. Similar observations had been made by Qorro (2006) through her review of studies linking the quality of education to language of instruction in Tanzania. Her remarks on teachers passing on incorrect English to students is sobering and is probably true of teachers described in this study: "This point is not meant to condemn or berate teachers; it is meant to illustrate that teachers are not the cause of the problem but rather products of a bad language policy, who have, over time, become victims of the language problem" (p.5).

Several explanations were given after pointing out the mispronunciations in the teachers' transcripts and inquiring about how they arrived at the pronunciations. This was Farina's explanation:

Extract 5.67T

I'm self taught. I simply guess how it should be said (laughs). This is how it is with lazy people. To be frank, I didn't learn from anybody. When you spoke to me I listened to your pronunciation and I thought ooh...(that's how it is pronounced). Well, I don't really have any friends as a point of reference, nobody. Sometimes I do ask but we tend to have different pronunciations. I haven't asked anybody to teach me correct pronunciation. I pronounce words my way.

When asked why teachers did not consult their colleagues about pronunciation matters, Salmiah explained it in this way:

Extract 5.68T

We have similar ideas so there's no point asking. We face the same problems.

Salmiah implied consulting colleagues whom she knew were equally limited in English proficiency was futile. When inquired about using the dictionary available on CD-ROM which the Ministry promised to provide, it was disclosed that none had been received. In fact, teachers were not even aware of this entitlement.

Met (1995) believes that teaching in a students' second language requires a repertoire that is greater than that of teachers of monolingual settings. This is important as teachers would have options available should one way to teach a skill or concept is ineffective for a given individual or group of students. Through the interviews, teachers showed they were aware of the theory of teaching that children understand better when the abstract is made concrete for them. They had awareness of the importance of providing children with multi-sensory science experiences when they reported using a variety of materials to prevent enthusiasm from waning. They talked about using textbooks, worksheets, computers and courseware as well as bringing in realia. Teachers said they simplified and clarified language through mind mapping, translations and code-switching to enhance comprehension.

The study also found that teachers were aware of the role of interest in learning. They frequently talked about supporting reluctant students and making concessions to engage them. One of the strategies to get students interested and to apply themselves was to permit those who had problems expressing ideas in English to use Malay. Farina stated:

Extract 5.69T

I mean we need to give the students a choice. If they feel they can cope with English then English it is. If they aren't confident about English then I'd recommend they use Malay. Because I want to arouse their interest so that they'd better understand. If it's English both the teacher and the student are under stress. When we teach them, the students sit idle. Surely they won't know.

All the teachers adopted flexibility in their attempts to reduce anxiety among the students. According to Krashen (1981), lowering the affective filter is important to encourage engagement among students. However, as CBI teachers they are expected to use Malay with discretion as they have a double identity in the science classroom: one as a teacher and the other as a “learner” of CBI. Additionally, heavy reliance on Malay did not facilitate the development of students' ability to learn and discuss science content through English. Farrugia (2003) argues that regardless of the language used in teaching, the teacher would need to spend time on subject specific expressions and their meanings. This is because using English as medium of instruction does not render understanding of such expressions automatic.

Encouraging students to speak English and praising them for their efforts were strategies used by Zuleyka to support her students:

Extract 5.70T

Encourage them to speak English. Get them to speak in English during class. Praise them for their effort.

The teachers also revealed their knowledge about the social nature of teaching through the incorporation of group work in their lessons. Teachers were aware that teaching and learning is a social process which requires interactions not only with the teacher but also with others in the classroom. They also knew that working with peers can enhance motivation. Apart from allowing students to do seatwork individually, teachers frequently organized students to work in pairs or small groups which allowed students to interact with their peers and learn from each other. It is believed that the teachers'

expanded repertoire was influenced by their knowledge of students and how these students learn. Zuleyka acknowledged that students' receptive ability was greater than their productive skills:

Extract 5.71T

They can (answer in English) but at only the word level. Coming up with sentences is still a problem. For example, when we ask in English why a certain animal has become extinct. They know the term extinct, they understand but they won't be able to answer that in a sentence in English.

Although these teachers have an array of ideas about teaching, it was noted that their practice did not always follow the knowledge about teaching they possess. Salmiah's testimony illustrates this point:

Extract 5.72T

When I teach a topic for the first time I just explain. I don't use teaching aids. If they don't understand then the second time round I bring in teaching aids. We don't have time, right? If I do have the time I would definitely use aids but not so in my present situation. We don't have a pool of teaching aids in this school. You may have noticed we don't use much teaching aids. We work around whatever resources are available. Teachers don't have time.

Salmiah's wait-and-see strategy reflects her as a poor decision-maker, thus, making her a poor teacher for CBI. Rather than wait for problems to surface before looking for a better option for trouble-shooting, effective teachers would have strived to select the best option to meet students' needs from the outset. Effective teachers must have the ability to make good decisions. Met (1995) maintains that good decision making requires more than an awareness of the many options available. It requires the ability to select appropriately from this range of options.

5.9 Curriculum Knowledge

As stated earlier teaching resources supplied by the MOE and workbooks from local publishers are a staple of teachers' curriculum knowledge. Hence, it was not surprising that they showed shallow pedagogical content knowledge. For example, Farina was at a

loss to make her students grasp the concept of variables. She continued teaching the students in the same ineffective way using the same materials. Both lessons observed involved measuring spring extensions to discuss the concept. It is hard to imagine the 10-year-old children getting excited about spring and they were not. Although at first glance talking about spring extension may seem like real-life situation, the subject of discussion is really only realistic to adults and not for children (Farrugia, 2003). Farina could have made the lessons relevant to the children by asking them to recall things they know which had spring as a component or ask them to speculate in what instances it is important to know how much a spring can stretch, or why anybody would want to know such information. She did none of this.

To convince her that the students were capable of learning the abstract concept of variables, a story was written about a hungry crow stumbling upon a pitcher half-filled with water (i.e. the constant variable). Marbles were used to represent manipulated variable. The story had the crow putting in the marbles into the pitcher. A pattern was observed (i.e. the responding variable) each time the crow put a marble into the pitcher. The story was accompanied with a table for students to chart the changes in water level. It also had simple questions using everyday English which gradually moved towards the introduction of the scientific terminologies. Suggestions about how everyday activities like mixing drinks or spreading jam on slices of bread could be useful ideas to make learning the concept manageable were also made. In order to manage a few difficult characters among her students, it was also suggested that students be asked to sit together on the floor to minimize discipline problems.

The story it turned out became her teaching material later. She even had the students come forward to sit on the floor. Additionally, she came in with props and appointed a boy to be the crow who acted out the role as she narrated the story. The only

disappointment was that the same piece of A4-size paper given to her was used for the lesson. Subsequently, she was informed that anything meant for everybody to see should be visible regardless of where they are in the classroom. The same advice was shared with Ruhani. She had tried to get a discussion going by placing pieces of A4-size papers on the board after students did group work. When she requested timid representatives to come forward to explain their work, she completely lost control of the class.

5.10 Syntactic Knowledge

In science, syntactic knowledge refers to the scientific method by which facts and concepts become accepted by scientists. The study found that the teachers did not exude deep syntactic knowledge of science. The rare occurrence of open questions in the teachers' discourse indicated this. The teachers' poor handling of the random open questions they asked was equally illustrative (see Section 4.12). Another example came from Farina's lesson on *absorption*. In that lesson, talk time and opportunities available in the experiments were not capitalized to let students explore concepts salient to the topic. When describing the result of putting a diaper into a tray of water, Farina and the class agreed that water in the tray "disappeared". However, why water did not disappear as much when items such as paper and cloth were placed into a tray with equal amount of water was not explored at all. Students were not invited to speculate why only some materials were absorbent. They were not encouraged to notice how absorbent materials were physically different from non-absorbent materials. Since the discussion was not dialogic in nature, students did not get much opportunity to practice using terminologies related to the topic in their verbal output. In fact, the word *absorption* was used only twice by the teacher and not at all by the students. Findings from this study are consistent with previous research involving ETeMS teachers (Sophia et al., 2010; Tan,

2011). Sophia et al. (2010) believes that “where teacher talk prevails in the classroom, if unaddressed, could have severe consequences on students’ learning and understanding of science concepts since it offers little opportunity for students to express ideas or ask questions” (p. 57).

5.11 General Pedagogical Knowledge

Observations showed that another reason the teachers were not very successful in the science through English classroom was their weak general pedagogical knowledge. Several examples pertaining to visual display and seating arrangement were already mentioned earlier (see Section 5.9). It was noted that besides the lack of planning for meaningful communication, the teachers were not always adept at realizing the full potential of the communication strategies they employed. For example, providing only one sample of opaque, transparent and translucent objects (see Section 5.7.1: Extract 5.62) to teach the concepts was a telling sign of weak general pedagogical knowledge. The insufficient concrete examples did not provide enough redundancy for students to grasp that objects made of plastic and glass can be transparent, translucent or opaque depending on the amount of light that penetrates through. A similar weakness was observed in Farina’s lesson exploring the concept *absorption*. Students who were divided into groups of six only had one specimen to experiment with. With only one object to investigate, the activity ended soon after it started, leaving a lot of time for idle talk and off-task behaviour.

The teachers were also not always correct in their choice of teaching strategy. During the lesson on circuits, only drawings were used by Ruhani to explain the topic to students. The class which was a low-ability group with some students described as slow learners, struggled to understand the lesson just by looking at the drawings.

The teachers' lack of general pedagogical knowledge was also evident in their habit of giving instructions while students were excitedly getting into groups. The tendency to overlook the importance of explaining ground rules caused students to come forward singly seeking help forcing teachers to repeat their instructions. Consequently, a lot of talk was focused on management instead of learning. Asking questions which attracted choral replies or answers from the more interested students because of failure to nominate a speaker was further indication of weak general pedagogical knowledge.

5.12 Substantive Subject Knowledge

Hashweh (1987) observed that science teachers with deep understanding of their subject matter differed from less knowledgeable teachers in their questioning behaviour. High-knowledge teachers were reported to plan to question about matters beyond the textbook which required synthesis. In contrast, low-knowledge teachers were more inclined towards questions requiring recall of facts. The teachers in the current study appeared to fall into the second category based on the ubiquity of low-level questions in their discourse (see Section 4.11.1: Table 4.13). It is believed that their substantive subject knowledge was weak because they rarely read or thought about it. Many aspects of teaching were already provided for teachers. For example, problems for solving, ideas for experimenting and ways to present data were all specified in the prescribed textbooks. Thus, much of what they presented was textbook science. The unfortunate consequence of having most of the work done for teachers was that it seemed to blunt their ability to think about their subject. For example, when doing the experiment on spring extension, Farina only found one retort stand and one piece of spring in the science room. In the experiment, students were supposed to investigate the length of extension of three springs of different lengths when a constant variable was attached to them. A lot of time was used getting students to come forward to measure the spring

lengths (i.e. the manipulated variable) before and after attaching the constant variable. This led to a lot of idle chatter as students had to wait for their turn. More time was wasted adjusting the position of the spring to fit the experiment. The experiment could have been easily adapted with a bit of ingenuity. For instance, different size stones which were readily available could have been used as the manipulated variable with the spring used as the constant variable instead. Instead of asking everybody to take the measurements, three different students could have been selected to carry out the tasks. This would enable a smoother transition from one phase of the experiment to the next besides enabling better time management. Of course, the lesson objectives could also have been achieved by doing a totally different experiment. The rigidity in following the ideas provided in the textbook did not allow much time for any other worthwhile discussion of the topic as much of class time was spent on procedural matters. Thus, students faced difficulty understanding the concepts taught causing Farina to scold them for their failure (see Extract 4.44). Farina actually thought she had fulfilled her duty, not realizing that the students needed a teacher who could transform the substantive knowledge into pedagogical content knowledge to assist their comprehension.

5.13 Pedagogical Content Knowledge about Content-based Instruction

Based on the findings so far, it is clear that teachers in this study had shallow pedagogical content knowledge as a result of the influence of the other twelve teacher knowledge bases. Although all the science and mathematics teachers in this school had attended the compulsory ETeMS course at some point during the implementation process, the findings suggest that there is still a need for continuous professional development. In general, they were positive about the course. Farina learned new English words and tips on how to communicate with her students although the training did not provide insights on how to teach science through English:

Extract 5.73T

Yes, it's useful. At least we get to communicate with the students and we get to learn how to explain in English. We pick new words.

Zuleyka returned from the ETeMS training with increased confidence. Ruhani claimed it helped to improve her English grammar. Ayesha, however, was critical of the lack of expertise shown by a trainer who was an English teacher but not a content expert:

Extract 5.74T

She's an English major so her language is good but she isn't so good when it comes to teaching science or maths, especially terminology.

Ruhani complained about the absence of suitable training materials:

Extract 5.75T

The problem arose when I was asked to teach Year 2. I was asked to teach this level but there was no syllabus for it (during the training). So I used the Year 1 syllabus instead.

Professional development is necessary to support and sustain teachers during a change process. Unfortunately, in this school this component that drives change was severely lacking. Other than attending the ETeMS course, most teachers at this school did not receive further training during the implementation period. Teachers who failed the English Proficiency Test, according to the MOE, are required to attend English language classes. It was discovered that a few teachers in this school had failed the test more than once but never attended such classes. Perhaps, the Ministry assumed the special allowance given to the teachers would be spent for that purpose. Without clear instructions for teachers to account for how the allowance was spent, none of the teachers sought ways to enhance their English language through course attendance. Only a few purchased self-learning materials but even these were not put to good use.

Zuleyka was a good example when she revealed that:

Extract 5.76T

To solve my problem I have to continue learning. Earlier I bought SPM English books and MUET books. I practised but stopped. I have no time now (laughs). I spend a great deal of time in school, I have two young kids, and I'm furthering my studies; and then there are co-curriculum activities. I only get to go home immediately after school only on two days and during the holidays and at weekends I attend classes at UM. I escort the kids for school competitions.

The teachers were not totally uninterested in learning. Ruhani and Zuleyka, for example, were pursuing their first degree on a part-time basis. But their intention for enrolling was purely for career advancement. The orientation of the academic exercise too was different and did not fulfill their needs as CBI teachers. This was proven by Ruhani's expressed desire for additional training to empower her:

Extract 5.77T

I got to attend the course just once and that was too short and rushed. It would have been useful and less taxing on us if the course was ongoing. So I don't agree. Preparation for getting us ready to teach was not comprehensive.

The inadequate training especially relating to teaching through English language, left teachers fending for themselves and wondering how they could develop their English language skills and their students'. Ayesha had this to say:

Extract 5.78T

I think about how to raise the level of English for both teachers and students. As teachers we need to use simple English in our explanations so that students can understand better. Sometimes we ourselves don't know what is simple enough for them to understand. If we are convoluted in our explanation students will be even more confused, right?

The above findings provide clues as to what should be given focus in professional development for science through English teachers. The teachers' comments must be noticed as they are after all based on their experiences in the classroom and attending training programmes.

5.14 Lack of Collaboration

Research (Fullan, 1993, 2001; Goodnough, 2008; Hiebert et al., 2002; Peers et al., 2003) has shown that one of many ways to develop professionalism is through collaboration. Fullan (1993, 2001) maintains that adopting a collaborative work culture is a requisite for successful change. The MOE's strategy to encourage this during the implementation of ETeMS was the buddy support system. Mentors (senior and proficient science and mathematics teachers) were supposedly trained to support science

and mathematics teachers (buddies) in the same school (Ministry of Education, 2004, p. 10). This is theoretically sound but implementing it in reality proved to be a difficult matter, especially in this school. The reality was no reliable help was available in school for consultations regarding teaching ideas or English language-related matters or to provide feedback on instruction. The buddy-support was not systematically planned and the school's adoption was not based on clear understanding of its mechanics. Perhaps this was because the idea was not conceived by the school but rather initiated by the people who designed the training program for ETeMS as a strategy to encourage continuous learning. Consequently, there was no advice as to how often teachers should meet, when and how often they should be observed, and what to focus on etc. The English language teachers, especially the English language Panel Head, by default were regarded as buddies for all ETeMS teachers. The trouble with this was that they too were not very clear about their role as buddies. It appeared that support given was dependent on individual teacher coming forward seeking help. The non-science teacher buddies never made the first move to find out what and how assistance could be provided. According to the English language Panel Head in the rare instances that her help was sought, the main focus was on vocabulary.

The available English teachers in the school it was observed did not function in English very much. They spoke the language only during lessons. Some of the English teachers were "conversion" teachers who took short courses to certify them for teaching English. In fact, out of the five science teachers observed three taught English due to teacher shortage, Zuleyka being one. The teachers rarely consulted each other for lesson preparations preferring to work in isolation. When they came together it was usually to discuss exam-related matters or after encountering problems in class. In a way, the buddy support in this school was ineffective due to lack of skilled resources. Perhaps, it was the teachers' awareness of this reality which made them prefer to work alone.

As mentioned earlier (see Extract 5.68T), it was understandable that the teachers were not driven to consult others from the school. However, it was unfortunate that the teachers did not realize there were others beyond the school they could consult. It was also unfortunate they seemed to think that learning from others was needed for language related matters only. They hardly talked about sharing with their colleagues or getting feedback from them about teaching or teaching materials despite knowing they were pressed for time to look into these matters on their own. Furthermore, the teachers appeared to underestimate the importance of collaboration. This conclusion was based on the researcher's experience with them. During visits to the school, the researcher used to sit in the staff room between observations. Teachers were welcomed to seek help with English. Despite the offer and developing close rapport with the teachers, only the English Panel Head came for assistance. The others sought help only during lessons, often when they were stumped or uncertain.

The ETeMS training did not give attention to developing teachers' knowledge of subject matter and instructional skills applicable to their subject as the programme was developed based on the mistaken assumption that teachers already possess these knowledge bases. There was evidence that the training was insufficient to make them see the various ways content and language can be integrated into their instruction (see Extracts 5.77T and 5.78T). Their lesson transcripts which revealed many missed opportunities attest to this. The teachers still have a lot to learn. Under such circumstances, it is believed that there is no guarantee that the quality of their instruction would be any better even with switching to the Malay medium of instruction for as long as they continue working in isolation and without receiving appropriate support.

5.15 Conclusion

The findings in the preceding chapter (Chapter 4) provide compelling evidence that teachers' limited language proficiency had a significant impact on the teaching of science through English. This evidence therefore, the researcher holds, provides sufficient support to argue for language proficiency as an imperative teacher knowledge base for ESL/EFL teaching in rural settings.

The findings of this chapter, however, revealed that the teachers did have all the teacher knowledge bases proposed by Turner-Bisset (2001, see Sections 2.5.1 to 2.5.11): knowledge of self, knowledge of learners: cognitive, knowledge of learners: empirical, knowledge of educational ends, knowledge of educational contexts, beliefs about the subject (science), knowledge/models of teaching, curriculum knowledge, syntactic knowledge, general pedagogical knowledge, substantive subject knowledge, and pedagogical content knowledge, albeit at varying strengths.

The findings in this chapter indicate that the knowledge bases in the teachers' repertoire strongly influenced their use of English in implementing the teaching of science through English. The knowledge base that had a telling impact was knowledge of self. All of the participants showed immense awareness of their lack of English proficiency and the resultant impact it had on their delivery. Their limited English made them dependent on teaching materials prepared by others as they did not have the ability to create their own. In explaining their preferred instructional language they revealed that using Malay enabled them to speak with a voice of authority. They talked about losing this sense of confidence when teaching in English. Insecurity and doubts about the accuracy of their statements are feelings shared by all the teachers. Their responses seem to corroborate the observation made by Jeffrey and Woods (1996) that it is important for teachers to 'feel right' in order to play their role. In their study of primary teachers' emotions

within the context of OFSTED (Office for Standards in Education) inspections, they revealed how the inspections had thrown teachers into disarray and self-doubt. Teachers experienced professional uncertainty which negatively influenced their personal selves and also their professional roles. Confidence in teaching and confidence in taking on the role of teacher has been shown in research to be closely related to a teacher's knowledge of self (Bandura, 1997; Nias, 1996). This is logical because it is hard to imagine a teacher who is not comfortable in his or her role being able to be an effective and convincing teacher. A teacher who perceives himself or herself as capable certainly would stand a better chance to weather even the most challenging situations and not give up easily. Nias (1996) states that the emotions experienced by teachers must be taken seriously as it can affect everyone in the contexts in which teachers work. In this study, the teachers' emotions which formed a part of their knowledge of self led them to perceive teaching science through English as a problem. The perception remained despite acknowledging that students had shown improvements in their knowledge of English. Teachers, in general, were not very receptive of the idea of teaching science through English as they were not able to appreciate the difficulties of adjusting to the demands of CBI. In fact, the demise of the ETeMS policy was not mourned but rather celebrated with joy. Comparing the attitude revealed by the teachers against that which is necessary for meaningful execution of the science curriculum showed that this aspect of teacher knowledge was wanting.

Knowledge of students, both empirical and cognitive, exerted a strong influence on the teachers' decisions about how English for teaching science was to be applied in their lessons. The teachers empathized with their students, in particular the weak learners whom they perceived as victims of ETeMS. These students who already had learning problems without ETeMS were said to lag even more with the policy in place. It was hard for the teachers to ignore the blank stares and the silence that greeted their attempts

to teach through English. Teachers perceived the weak students' learning opportunities eroded as the language barrier brought on by ETeMS was insurmountable. This justified teachers' decision to bend the rules in order to promote a fairer and more inclusive environment in their classrooms. The teachers were similar in the belief that English for science would be more successfully implemented when students have better grasp of the English language. This finding is consistent with that of other studies (Toll, 2001-2002; Turner-Bisset, 2001) that teachers make decisions based on engagement with students and out of concern for children's emotions. Indeed, knowledge of their students was another reason to explain why the teaching of science through English was hard for the teachers to embrace.

Teaching is a purposeful activity. All the teachers in this study appeared to share common short term goals for instruction i.e. teaching to the tests. In relation to this was the goal to cover the syllabus. Their responses revealed that orienting instruction for examination purposes was motivated by the importance placed on exam performance by the school and society in general. The teachers appeared to be under pressure to play the role to meet the needs of others (Hansford, 1988). To increase the likelihood of the school maintaining its performance, teachers were willing to compromise and their action was condoned by the headmistress. Their awareness that examinations were still administered bilingually made it easy for them to revert to Malay instead of persevering in English. Developing English language skills was never part of their goal as they did not perceive this to be their responsibility or a responsibility they could shoulder. This attitude might have been an indirect influence of the belief held by their ETeMS content trainers. The belief was that developing familiarity of science concepts in English was more important than developing the language skills to engage in scientific discourse. Consequently, instructions frequently focused on meaning with little attention paid to form. The findings corroborate Fullan's (1993a, 2001b) theory that you cannot mandate

what matters. The teachers and their headmistress did not appear to share the vision held by the policy makers. The lack of shared vision resulted in them making their own policy that fitted in better with their own needs and concerns.

Interviews with the teachers revealed a myriad of contextual factors which significantly affect their professional development and by extension their use of English. Pressures of time, conflicting priorities and heavy workloads left them with limited opportunities to focus on their lessons or reflect on their practice. It was regular fare for the teachers to enter the classroom without sufficient preparations. The lack of expert resources and supportive environment left teachers to fend for themselves and work in isolation. This made it difficult for the teachers to gain a different perspective of teaching or learn new skills about teaching. Hence, they frequently went about their work in a mechanical way or guessing pronunciation which often led to errors, particularly in their English language discourse. The conditions under which the teachers worked were far from ideal and seemed to prepare them more for failure than success. The scenario highlighted in this study is the direct antithesis of that described by Major and Palmer (2006) in a study of faculty members participating in a campus-wide problem-based learning initiative. The introduction of change was successful in this instance because “strong institutional support and encouragement were necessary to encourage faculty members to try new things, to learn from what they were doing, and to move forward in their work” (p. 631). The findings by Major and Palmer suggest that there is an urgent need to overhaul the school environments such as that observed in the current study in order to promote high-quality classroom instruction to serve students well. In writing about the six secrets of change, Fullan (2008) wrote “Professional development (PD) in workshops and courses is only an input to continuous learning and precision in teaching. Successful growth itself is accomplished when the culture of the school supports day-to-day learning of teachers engaged in improving what they do in the

classroom and school” (p. 15). Teaching science through English continued to be problematic for the teachers in this study because they could not push themselves to learn. This was partly due to the absence of supportive structures within their school and also their own lack of awareness of the ways to go about learning. Thus, there was no balance between working individually and collectively, and connecting with the wider environment which is critical for success (Fullan, 2003).

With regard to beliefs about science, Farina was aligned with behaviourist methods with emphasis on rote learning and drills. Her two colleagues were more current in their beliefs evidenced by their talk about science as doing and need for more student participation. However, observations revealed that their beliefs about science failed to alter their basic approach in practice. Although the teachers attributed much of the problems in their instruction to time pressure, I believe it is more than that. Part of their problem I perceive is the result of training which did not give attention to these areas. The ETeMS course which they all attended was developed based on the assumption that teachers already have knowledge of subject matter and the requisite teaching skills applicable to their subject. That being the case, the course was designed without attending to instruction in the content or methodology of the subject. It was planned as an interim measure to provide ETeMS teachers with the basic competency to use English in their instruction. This is because time was limited as the training was only 240 hours in total. Of the total, 60 hours comprised self-instruction. The independent learning package was meant to allow teachers to learn at their own pace to supplement the face-to-face training they received (Chan et al., n.d.). This is reasonable in theory but I did not see it in practice especially with no requirement for teachers to share their experiences using the self-instructional package. This impacted on their knowledge or models of teaching. These findings again emphasize the need to continue learning and to make skills and knowledge public through sharing (Chrispeel et al., 2007).

Additionally, the present findings seem to be consistent with other research which found that one-off training does not work (Fullan 1993a; Guskey, 1986; Hill, 2007).

ETeMS was a standard “one-size fits all” program conducted away from the school. It did not take into account the different teacher variables and environments where teaching takes place. For example, every teacher received the same input regardless of their English language proficiency, teaching experience, student population and the community they serve. Consequently, issues which were unique to the individual teacher were not properly addressed. According to Hill (2007), “Professional development can enhance teaching and learning if it has three characteristics. It must last several days or longer; it must focus on subject-matter-specific instruction; and it must be aligned with the instructional goals and curriculum materials in teachers’ schools” (p. 111). The ETeMS training was conducted for several days but it did not appear to have a strong feature of the second and third characteristics. Thus, teachers although they claimed to feel somewhat confident after the training, were still unenlightened on how they could effectively enact science teaching through English.

The years the teachers spent working in isolation and without much input from others about their instruction seem to blinker their understanding about instruction. The teachers appeared not ready to be left to work independently as they were neither resourceful nor reflective on their own. They certainly could do with some guidance and support from others to improve the quality of their lessons and to model how current beliefs about science education can be applied in instruction. If this is not looked into, teachers will continue teaching with a superficial understanding of what teaching science entails even after the reversal of ETeMS. This study has found compelling evidence to show that teachers are still short in several categories of teacher knowledge to make for a solid pedagogical content knowledge required for successful CBI. This is

unfortunate as the teachers spent a lot of time teaching both during and after school hours. The gaps in their teacher knowledge suggest that the many hours spent in the classroom in the past four years were just one year's experience repeated three times. Every change agent in the system must support these teachers in their work in the classroom if the many hours they spent teaching are going to amount to anything. This study supports the view: "Every person is a change agent" (Fullan, 1993a, p. 22) and that "change is a complex process" (ibid., p. 19).

The findings which were derived from empirical data certainly would provide useful guidance and reference for other CBI initiatives. The issues highlighted through the voices of teachers were invaluable in that they not only point to the importance of preparing teachers for their work in the CBI classroom, they also increase awareness about the roles of other change agents in supporting teachers in enhancing their practice.

CHAPTER 6

SUMMARY OF FINDINGS AND CONCLUSIONS

6.0 Introduction

The English for the Teaching of Mathematics and Science (ETeMS) policy introduced in 2003 in Malaysia has had a rather tumultuous journey and in its closing stages the teachers entrusted with implementing the policy held centre stage for the wrong reasons. Questions were raised about teacher preparedness (Ambigapathy & Revathi, 2003; Mohamad Fadhili et al., 2009). In this study a prepared teacher is broadly defined as one who has in her repertoire the requisite knowledge bases for expert teaching as proposed by Turner-Bisset (2001) including proficiency in the medium of instruction and one who is supported by other stakeholders within the educational system (Fullan, 1993a, 2001b). This study examined the role of language proficiency as a significant teacher knowledge base in the teaching of science through English. It investigated the teacher talk of LEP teachers in the rural classroom and its impact on the teaching of science through English, on the one hand, and the extent to which teacher knowledge bases influenced the teachers' English language use, on the other. Three LEP teachers in a rural primary school, charged with the daunting task of delivering a new science curriculum underpinning the ETeMS policy provided data for analysis. Findings were culled from transcripts of nine lessons taught; classroom observations, teacher interviews, teacher questionnaires and documents.

6.1 Summary of Findings

The study uncovered various challenges facing LEP teachers in their transition from teaching science through Malay to teaching science through English which is a form of content-based approach instruction (CBI) (see Chapters 4 and 5). These challenges

were either intrinsic i.e. teacher-related, or extrinsic, i.e. inadequate support from other stakeholders. In order to implement meaningful instruction of science through English using the CBI approach, teachers must meet certain criteria to help resolve challenges. Criteria for meeting intrinsic challenges are *Professional knowledge and understanding* (Finger & Houguet, 2009; Fullan, 2001a; Turner-Bisset, 2001), *Professional adequacy* (Fullan, 2001b; Nias, 1996; Turner-Bisset, 2001; Zembylas & Barker, 2007), *Professional attitudes and values* (Darling-Hammond, 1990; Fullan, 2001b; Toll, 2001-2002; Turner-Bisset, 2001; Vulliamy et al., 1996), *Teaching approach* (Bisschoff, 2009; Cohen & Ball, 2001; Finger and Houguet, 2009), *Ownership* (Alemu & Tekleselassie, 2006; Bisschoff, 2009; Darling-Hammond, 1990; Evans, 1996; Finger & Houguet, 2009; Fullan, 2001b; Treagust & Rennie, 1993; Welner, 1999); and those for extrinsic challenges are *Resources* (Evans, 1996; Finger & Houguet, 2009; Fullan, 2001b), *Time management* (Croll et al., 1994; Darling-Hammond, 1990; Finger & Houguet, 2009; Fullan, 2001a, 2001b), *Practicality of Implementation* (Giacquinta, 1973; Jenlink et al., 1998; Toll, 2001-2002), *History and tradition* (Bucuvalas, 2003; Tsui, 2007), *Professional development and support* (Cohen & Ball, 2001; Fullan, 2005; Guskey, 1986; Jenlink et al., 1998; Ramatlapana, 2009; Zembylas & Barker, 2007).

The following section will discuss the findings in relation to the above criteria in order to demonstrate how the combination of intrinsic and extrinsic challenges significantly impacted the preparedness of the LEP teachers in the CBI classroom.

6.1.1 Intrinsic Challenges for Teaching Science through English

The intrinsic challenges in the teaching of science through English uncovered in this study are problems which originated with the teachers. These challenges which undermined LEP teachers' readiness for applying the CBI approach are discussed below:

6.1.1.1 Professional Knowledge and Understanding

Turner-Bisset (2001) believes expert teaching, in the case of this study successful teaching of science through English, requires a high level of teacher knowledge and understanding. According to her, teacher knowledge can be classified into several categories which include among others substantive knowledge, syntactic knowledge, beliefs about subject, curriculum knowledge, knowledge/models of teaching, general pedagogical knowledge, knowledge of context, knowledge of learners, knowledge of self, knowledge of educational ends, and pedagogical content knowledge. In addition, the researcher opines that within the ESL/EFL contexts, teacher proficiency in the medium of instruction is also a critical constituent of knowledge. This opinion is based on the findings which reveal that one of the components of knowledge that seriously impeded teachers' readiness for teaching science through English was teacher proficiency. Limited mastery of English significantly weakened LEP teachers' attempts to transition toward teaching science through English. For the teachers, limited English caused a crisis in confidence. There was evidence that teachers resorted to strategies which ran counter to those associated with CBI in order to cope. In addition, they were unable to recognize and optimize language teaching opportunities in their lessons.

Part of the reasons teachers' struggled to teach science through English was related to their lack of knowledge of effective L2 pedagogy in CBI. The lack of knowledge did not empower them to provide lessons which integrated content and language learning; an important element in CBI. Consequently, superficial modifications were made to instructional routines which had been developed over the years. The findings support the belief that besides competence in the medium of instruction and qualifications for teaching a particular subject, teachers need to have knowledge of CBI methodology to become successful teachers of CBI (de Graaf et al., 2007; Lehtse, 2012).

6.1.1.2 Professional Adequacy

Limited English proficiency was a real problem which affected teachers' sense of professional adequacy. Teacher interviews showed that all the teachers were apprehensive about their ability to teach science using the new approach as they knew it was imperative for them to develop high levels of professional adequacy to enable them to teach meaningfully. Knowledge about their own limited proficiency in the medium of instruction affected the level of confidence they had in their ability to perform the necessary changes required in teaching science through the language.

Although teachers felt more confident having had a few years of experience in teaching science through English, their sense of inadequacy remained as they had made little progress in their English language skills. They expressed concern about the impact of their instruction, particularly on students' language development. They still had issues with the ETeMS policy as they continued to struggle on a daily basis. Without a strong sense of professional adequacy, it was a challenge for the teachers to make changes in their instructional practices. The findings support Fullan's (2001) theory that what teachers do and think is of significance to an educational change.

6.1.1.3 Professional Attitudes and Values

Change theorists (Evans, 1996; Fullan, 1993a, 2001b; Jenlink et al., 1998) believe that attitudes and values that teachers have are crucial in determining success in the implementation of a particular curriculum. In the case of this study, it was important for teachers to adopt the attitude and belief that the language policy for teaching science was a solution to theirs and their students' English language problem albeit a difficult one to attain. However, the findings revealed that the teachers were incapable of this

because they often regarded the policy as a source of problems- either for them or their students or the community at large.

Despite acknowledging the long-term benefits of ETeMS, teachers did not develop enthusiasm to overcome inadequacies they identified in themselves. Their actions in the classroom were influenced by various components of their teacher knowledge such as empirical and cognitive knowledge of learners, their beliefs about science and how it should be taught, and knowledge of educational context. Apparently, this is not unique to the teachers in this study as similar observations of ETeMS teachers have been reported by other researchers (Sophia et al., 2010; Tan, 2011).

6.1.1.4 Teaching Approach

In order to become successful teachers in the CBI classroom, it is crucial for teachers to be flexible and adept at modifying teaching approaches to meet students' needs and the demands of the new curriculum. According to Cohen and Ball (2001), interventions in instruction entail, among others, learning. "Because interventions in instruction aim at improvement, and therefore change, they depart in some degree from current practice. Therefore, enacting them requires practitioners...to learn new skills, or to mobilize the will to use more effectively what they already know and can do" (ibid., p. 76). Adjusting their practice was a challenge for the teachers as it was difficult for them to depart from their old ways of teaching science which made them feel secure and successful. Jeffrey and Woods (1996) attributed this to teachers' desire to 'feel right' in order to play their role. Old teaching styles enabled teachers to progress through the syllabus smoothly but prevented them from applying strategies that align with the CBI approach. Generally, their lessons were teacher-centered in which rote learning was emphasized.

6.1.1.5 Ownership

A high level of ownership is imperative to achieve success in the science through English classroom. This study has found that teacher ownership was generally low because the new teaching approach in their science classroom was mandated and was drastically introduced. Apart from the change that was externally initiated and drastic, this study found that teachers' insecurities about their limited proficiency and time constraints also contributed to their reluctance to accept ownership. The problems which persisted in their science classrooms and their disinclination to collaborate further affected their level of ownership.

Before ownership can develop, teachers must have a clear understanding of the meaning of change. "Our response to change, particularly when it is imposed on us, is determined by how we understand it, what it does to our attachments and beliefs, and how we can fit into the sense we make of our world" (Evans, 1996, p. 17). Learning in context i.e. learning which is built into the day-to-day culture of the school both at the individual level and collectively, is one way teachers can cultivate personal and shared meaning to change (Fullan, 2001b). It is especially important for teachers in this study to examine their practice regularly. They must be able to see aspects in their current practice that require them to act differently to reflect the needs of the new curriculum in order to find meaning. They must appreciate continuous learning in order to develop mastery and competence which are also means for achieving deeper understanding. However, the findings show that learning in context hardly occurred because negative attitudes and teachers' working environment which was not conducive were formidable obstacles. Teachers did not develop new mastery or new mindsets to successfully teach science through English. They never claimed ownership.

6.1.2 Extrinsic Challenges for Teaching Science through English

Besides the intrinsic challenges that weakened teachers' effort at teaching science through English, there were also extrinsic challenges which caused similar effects. The extrinsic challenges are described below:

6.1.2.1 Resources

It has been pointed out that various resources such as human, material and funds (Carless, 1997; Fullan, 2001b) are required for an educational innovation such as ETeMS. In implementing science through English, money was less a concern at the classroom level as the government had sufficient funds for ETeMS than human and material resources were. Teachers' concerns about human resources included the need for assistance to manage students and the setting up of activities during science experiments, and help with clerical work.

In addition, they alluded to the importance of having access to mentors for consultations regarding instruction. Deployment of teachers to solve the shortage problem at the school was also raised. These challenges were major factors which affected teachers' enthusiasm and commitment for teaching the new science curriculum. For example, the MOE's refusal to entertain requests for additional English and science teachers resulted in teachers having to manage a demanding timetable. Teachers could not rise to the challenge. Teachers' concern for student safety motivated them to forgo certain activities which were perceived as risky. The teachers raised issues about the endless clerical work they had to manage which they perceived should not be part of a teacher's portfolio.

With regard to material resources, several weaknesses in the school infrastructure were discovered which affected instruction. LCD projectors supplied to the school were not

properly installed in the specified classrooms. The computer room, the only place which had a complete set-up, was located in a different block. Short teaching durations made relocating an average class of 35 students from the classroom to the computer room a challenge.

In its effort to support teachers who were affected by the ETeMS policy, the MOE had committed itself to providing schools with computers. It envisioned a learning process whereby teachers and students going beyond textbooks by accessing online materials. However, such a lesson rarely occurred in this school as many computers had fallen into disrepair. The MOE, it appeared, had not scheduled maintenance checks and repairs. Besides malfunctioning computers, access to internet was slow. These challenges and frequent power outage were enough reasons for teachers to continue with chalk and talk instruction. Consequently, using new technology for teaching remained something teachers learned during ETeMS training but rarely applied in their practice.

Another concern related to resources among teachers was the dated and ill-equipped science room which they believed needed upgrading. Going ahead with hands-on activities in this room was time-consuming as teachers had to direct students to wait their turns for completing tasks due to a shortage of supplies. The shortage left little time for important discussions about content and on occasions forced teachers to forgo certain scientific investigations. As alternatives, teacher demonstration or drawings were used. Naturally, these alternatives could not provide the same learning experiences as hands-on activities would.

Also an extrinsic challenge in the teaching of science through English was the lack of dictionaries with CD-ROMs. All ETeMS teachers were entitled to a dictionary with CD-ROM but none of the teachers at the school had received any. Without this important tool and with teachers not being resourceful enough to look for other sources,

students acquired various incorrect input provided by the teachers especially with regard to pronunciation.

The contents of prescribed textbooks posed another challenge for teachers. All the teachers noted the scant verbal content in these materials. Limited mastery of English did not empower teachers to provide quality input in English merely based on the graphic stimuli contained in these resources. Time constraints and limited curriculum knowledge prevented teachers from supplementing the textbooks.

6.1.2.2 Time Management

Time management was a challenge expressed by all the teachers in this study. As ETeMS teachers, their workloads were heavier than colleagues who taught other subjects since they had to teach extra classes. No concessions were made by the school administrators to ETeMS teachers in terms of pastoral and non-academic duties nor did their non-ETeMS colleagues offer to take on more responsibilities as a show of support. The school's requirement for full teacher participation in the various competitions it partook further eroded time availability. Consequently, teacher learning, reflection on practice and even lesson preparations were compromised. This affected teachers' ability and motivation to change their old modus operandi for classroom teaching. In fact, this study has discovered that putting the best foot forward was not always the teachers' first option. This was evident from the disclosure that teaching strategies which assist comprehension but require time to prepare were second choice to chalk and talk. This should not be the case as there is no 'later' for effecting meaningful learning.

6.1.2.3 Practicality of Implementation

Practicality of an implementation influences the inclinations and enthusiasm of teachers to make changes (Carless, 1997). Practicality is determined largely by how compatible

the new curriculum is to existing classroom practices. In this study, teachers responded unfavourably to teaching science through English as they perceived little tangible benefits by doing so. The new curriculum was deemed incompatible with the local context they served. Neither teachers, nor students nor the community were well-versed in English. Teachers argued that the new language policy for teaching and learning science put rural students at risk. Consequently, they proposed to the school head that Malay be used with perceived poor learners. The proposal was believed to be a practical solution to students' inability to function in English and to safeguard the school's standing. This is obviously a case of lack of clarity about goals and means which in turn affected practicality of implementation.

6.1.2.4 History and Tradition

It is believed that the difficulties the LEP teachers faced in teaching science through English is closely related to teachers' educational history and tradition. Several scholars (Bucuvalas, 2003; Tsui, 2007) have pointed out that these are developed in the classroom, education programs, student teaching, and actual teaching. The history and tradition of teaching and learning science for teachers in this study had been in Malay prior to the ETeMS policy. Thus, teachers did not have the necessary English language skills for talking about science or for teaching science through the language. This together with the lack of experience and knowledge required to apply the CBI approach were among the factors that made the difficulty and extent of adjustment required for teaching science through English overwhelming for the teachers. Infrequent support and professional development was insufficient to make up for the lack of history and tradition.

6.1.2.5 Professional Development and Support

The teaching approach associated with the ETeMS policy is complex and requires special skills in integrating content learning and language learning. The complexity is greater for teachers who bear the responsibility but lack the requisite skills and proficiency for the job such as the teachers in this study. According to Cohen and Ball (2001):

The more ambitious the interventions are and the more they depart from conventional practice, the more learning is required. The more learning is needed, the more likely it is to require explicit teaching, rather than quick self-instruction on the job. Enactment of more ambitious interventions depends even more heavily on learning and teaching and the mobilization of will (ibid., p. 76).

ETeMS is an ambitious intervention which departs from teachers' existing practice. Therefore, continuous professional development is critical to ensure teachers build the "capacities (conceptual/process skills and knowledge as well as attitudes and mindsets) that will support their active and successful participation" (Jenlink et al., 1998, p. 221). However, the findings show that planning for professional development was not as systematic as it should be. The ETeMS training was about the only major in-service program attended by teachers and it did not provide teachers sufficient strategies for teaching science through English. The designers of the training programme assumed it as a given that teachers could manage on their own, using teaching experience they had accumulated. This assumption appears to be misguided as the findings revealed that besides deficiency in English, teachers showed weaknesses in other knowledge bases deemed important for teaching content through a second language. This inevitably weakened the teachers' ability to be effective instructors for CBI as the blending of all their knowledge bases did not result in strong pedagogical content knowledge. The findings of this study support the view expressed by Lawson and Briar-Lawson (1997) that "Teachers cannot give to others unless they are themselves nurtured" (p. 59).

This study also discovered that little follow-up occurred during the implementation phase of ETeMS. Inadequate monitoring through school visits by the school inspectorate deprived teachers of assistance and feedback about their performance during the critical and difficult phase. Teachers continued to rely on teaching approaches which did not support CBI as their attention was rarely drawn to their practice.

With regard to developing proficiency in English, teachers who failed the compulsory English Proficiency Test were required to attend English language training. However, it was not made clear where teachers should go for training or how they would be monitored. Hence, teachers continued failing the test but did not get or seek language training as there was no pressure put on teachers to enhance their mastery of the English language.

The above findings the researcher accepts are those obtained from a small sample of teachers from one rural school and they may not allow her to make generalizations about other populations. Nevertheless, the findings of this study deserve attention and could be the basis for future research.

6. 2 Responses to the Research Questions of the Study

The findings discussed in Section 6.1 addressed the research problem of this study in a broad manner. This section, however, will focus on the two research questions posed in Section 1.13 and discuss the extent to which they are addressed in this thesis.

Research Question 1

How does the nature of teacher talk of LEP teachers impact the teaching of science through English in primary classrooms?

- a. What is the impact of language choice on the teaching of science through English in primary classrooms?
- b. Do language choice preferences in realizing pedagogic functions affect the teaching of science through English in primary classrooms?
- c. To what extent does the command of language affect the teaching of science through English in primary classrooms?
- d. How does the quality of questioning techniques affect the teaching of science through English in primary classrooms?

The study revealed that the language use of LEP teachers affected the teaching of science through English in primary classrooms in significant ways.

1a. Language choice

The study has found that the use of English by LEP teachers during science lessons was constrained by topics and activities as limited knowledge of English did not afford facility to access various words and structures in the language. Teachers were also noted using more English when addressing the class as a whole than when attending to students individually or in small groups.

Teachers were unable to remain consistent in their L2 use because of their limited English skills. They depended on language alternation to deliver lessons because of difficulty in sustaining talk in English. This was done by switching completely to Malay or to insert constituents of English language, usually science concepts, into Malay utterances. It was concluded that the teaching of science through English by LEP teachers was negatively influenced by the teachers' inability to limit the use of Malay.

1b. Language choice preferences in realizing pedagogic functions

The findings show that the LEP teachers' language choice preferences in realizing pedagogic functions did affect the teaching of science through English. For example,

teachers were inclined to use English for functions which could be accomplished easily such as *pointers*, *evaluation*, elliptical *reformulations* and simple *directives*. The teachers' preference to use English for these functions which did not challenge their linguistic skills meant that the L2 input students received were brief and required little verbal response. With regard to *restatements* in L2, they were not always of high quality as they were often elliptical in form. The *restatements* were believed to be the teachers' attempts at using English and increasing L2 input for their students. L2 *restatements* also were teachers' strategy for focusing on form. L2 *modelling and drilling* which was another strategy used to focus on form was used mainly for vocabulary and pronunciation.

L1 was the preferred choice for expressing emotions and asking *genuine questions* as it was easier for teachers to do so. In addition, with few restrictions placed on the use of L1, *reformulations* through translation became an important strategy for the teachers to express themselves. *Reformulations* from English to Malay served to increase meaning and to perform self-corrections. *Restatements* in L1 were preferred as a strategy to increase comprehension of L2 utterances.

1c. Command of L2

The LEP teachers' command of L2 significantly affected the teaching of science through English. This study found that generally the L2 used by the LEP teachers was susceptible to errors as their limited proficiency made them unaware of the inaccuracies in their talk. Consequently, it prevented the teachers from monitoring their language efficiently. Limited proficiency also made the teachers inclined towards focusing on meaning without giving sufficient attention to accuracy of form. Teachers rarely engaged students in form-focused talk as their limited English knowledge made them unprepared and unwilling to engage in such interaction. This finding is comparable to

that of the teachers in the study by Dalton-Puffer (forthcoming) who professed that mistakes did not matter in their science lessons. Dalton-Puffer believes that teachers should not adopt this attitude as they are likely to convey it to their students who need “to move from semantic to syntactic processing” (p.12).

Other contributing factors in the errors that occurred include teachers’ tendency to speak in L2 which was based on L1 grammar, repetition of errors found in the textbook, and teachers’ coping strategy which involved speaking in L2 which was reduced in form. With regard to faulty pronunciation, all the errors were the products of teachers’ guesswork. Students acquired much of the mispronunciations as teachers tended to model and drill them in teaching topics which extended over a few days. To add, there were errors in the teachers’ language use that also distorted the factual truth of the contents students learned. These came about because teachers were not very precise in their word choice or had memorized words without really understanding their meanings.

The teachers’ limited command of L2 also resulted in teacher talk which was lacking in creativity. Teachers were unable to show richness of the English language through their talk as they were reliant on the turn of phrase found in textbooks or used in exam situations. They reverted to L1 to progress with delivery when they did not succeed at recasting their utterances in L2. The teachers’ constant use of L1 or reliance on fragments and simplified structures of English were not useful linguistic input that students can emulate.

1d. Quality of questioning techniques

The teaching of science through English was affected by the quality of teacher questioning techniques in several ways. The study found that teacher questioning techniques could not promote meaningful student participation as students were

frequently requested to provide brief choral responses to display or truncated questions or those involving choosing from provided alternatives. It has been pointed out that low-knowledge teachers were more inclined towards questions requiring recall of facts (Hashweh, 1987). The role of teacher talk in general and especially of teacher questioning, is critical in determining the opportunities available for students to gain an understanding of new knowledge and the skill to apply the knowledge in a variety of contexts (Chin, 2007; Davis, 1914; Savage, 1998; Sharpe, 2008; Wragg & Brown, 2001).

Teacher questioning has been shown to be a simple but powerful method for engaging students to develop language skills (Galloway & Mickelson, 1973; Sage, 2006). However, the findings show that LEP teachers were not very successful at using questions to develop students' language skills in the science through English classroom. Teacher questioning, for example, was frequently elliptical or consisted of compound questions and wh-questions which were poor in quality. Teacher questions therefore were not useful input for students to emulate or use as a basis to structure their responses. Teachers' inability to deal with student responses which differed from their targeted answers further denied students the chance to refine their thinking and their language use. In this regard, teachers retained their dominance in the classroom through their talk and prevented students from taking on more active roles in their own learning which is crucial for their cognitive and linguistic development.

The teachers' disinclination to nominate speakers was another quality which affected their execution of science through English. Teacher questions which were frequently directed at the whole class resulted in high occurrence of choral replies which afforded some students to disengage themselves from the lesson. Additionally, rare requests for students to respond in L2 did not encourage student output in the language. This also

meant that teachers themselves were not provided with a means to check students' understanding of subject specific words and expressions in L2 (Farrugia, 2003).

Teachers often encourage students to ask questions by telling them that every question has its merit and can contribute to learning. However, as correctly pointed out by Brualdi (1998), the same does not apply to teacher questions. "The content of the questions and the manner in which teachers ask them determines whether or not they are effective" (ibid., p. 3). Following this logic the teachers in this study can be considered as ineffective based on the preceding observations. In addition, another weakness in the teachers' questioning techniques was their tendency to ask questions randomly which stemmed from lack of preparation. When unable to scaffold talk to assist students in responding to the randomly asked questions, talk was terminated.

As CBI teachers it was important for the teachers in this study to use English and to use it in as many teaching acts as possible. The teachers were also expected to plan lessons which promote the linguistic fluency of their students. This study finds that it was a challenge for teachers to do these because of their limited English. Teachers used Malay liberally in order to cope with the demanding task of teaching science through English. The unrestrained use of Malay could not motivate students to persevere in their attempts to learn science through English. The quality of the teachers' questioning techniques was another factor which made the possibility of developing students' language skills in English remote. The analysis of teacher talk revealed that abundant opportunities to develop language skills through teaching science through English were not appropriated by the LEP teachers because they simply could not.

This section continues with the response to the second research question of the study.

Research Question 2

What teacher knowledge bases did the LEP teachers have/did not have that influenced their English language use in the teaching of science through English?

Although in varied strengths, the teachers in this study did have all the knowledge bases identified in the Turner-Bisset (2001) Model of teacher knowledge bases for teaching and these influenced their language use. They fell very short, however, as far as language proficiency in L2 is concerned.

Language Proficiency

Language proficiency is a significant knowledge base, though not included in the Turner-Bisset (2001) Model, which has had a telling impact on the teaching of science through English. Limited English proficiency caused teachers to use Malay as a fall back rather than as resource to be used judiciously. Malay was used extensively in their talk for various pedagogic functions which were difficult to perform in English because of their limited repertoire. The teachers' English language talk was noted to be formulaic and simple in its structure. Their talk in English was characterized by fragmented or reduced forms of the language and was often erroneous. The errors were passed on to students as teachers were unaware of them or did not know how to correct them. The findings help to explain the belief held by several advocates of CBI that all content teachers have to be language teachers (Hillyard, 2011; Met 1995). Teachers cannot be expected to support their students' language development through their content classroom if they themselves have not developed sufficient proficiency in the language.

Knowledge of Self

Teachers need confidence in order to do their job (Jeffrey & Woods, 1996). Teachers in this study, however, did not have the confidence to teach science through English

because they perceived themselves as not qualified for the job. Limited proficiency greatly affected their level of confidence as they recognized their lack of resources in English created difficulty in communicating ideas. Interviews revealed that teachers' had doubts about their ability to make students understand when they taught through English. Teachers reported experiencing problems accessing English words during instruction. These are reasons enough to justify their heavy reliance on Malay. In general, teachers were aware that there was an urgent need for them to enhance their proficiency in English to reach sufficient familiarity with the language before they could use it with more confidence in the science classroom.

Substantive and Syntactic Knowledge of Science

Teachers need strong substantive and syntactic knowledge of science, that is, subject matter knowledge to be able to transform that knowledge into powerful representations that allow meaningful student learning (Shulman, 2004). The level of understanding teachers have of their discipline can be seen through the questions they ask. High knowledge teachers it has been observed do not confine themselves to low-level questions or limit their talk to matters within textbooks (Hashweh, 1987). The findings show that the teachers appear to have low knowledge of their discipline. This deduction is based on the observation that teachers were entirely reliant on prescribed teaching materials to talk about science and the fact that the majority of questions they elicited did not give priority to evidence when explaining scientific phenomena. This consequently made the materials the authority for scientific information. Students were frequently not required to discuss scientific facts. Teachers rarely generated talk which is associated with the norms of the discipline: attending to the role of evidence, interpretation, and explanation. Students, thus, had limited opportunities to verbalize the ideas presented in their lessons to create their own understandings or to develop science discourse.

Curriculum Knowledge

The findings show that teachers had limited curriculum knowledge for planning CBI lessons. Their instructions were mostly based on prescribed instructional materials as they rarely had time or spent time to look for alternative ideas. Since these materials had low verbal contents, teachers' exposure to English language for science was also low. Understandably, the language input based on these materials impacted on the richness of input provided as teachers had not been exposed to enough English language to discuss science contents.

General Pedagogical Knowledge

Both teacher interviews and observations did not offer evidence that teachers had strong general pedagogical knowledge. This certainly had a bearing on their language use in the science classroom. Weaknesses in the teachers' general pedagogical knowledge were manifested through poor time management and classroom management which encouraged misbehaviour among students. Teachers' lack of awareness of certain basics of teaching: using visuals which were too small to be seen and getting students to do experiment but without providing sufficient materials to experiment with, also induced misconduct among students. Teachers frequently had to suspend instruction in order to attend to discipline problems.

Beliefs about Science

The teachers' beliefs about science pose a serious hurdle to successful teaching of science through English as they had imposed a very narrow interpretation of an approach which has much to offer. The study has found that in general teachers believed that talking about science simply means focusing on learning concepts. Teachers did not concern themselves with accuracy of language use or focus on talk that could assist students' language growth. They did not perceive any harm in frequent inserting of

science concepts in English into Malay utterances or switching completely to Malay. Some scholars believe that code-switching is counterproductive to learning the target language (Doraisamy, 2012; Hillyard, 2011) and could hold back ESL learners' acquisition of content knowledge. In fact, Hillyard (2011) states that teachers "need to be effective in the language of teaching ... must be comfortable in using English at all times in the classroom and never resorting to the mother tongue except in special circumstances" (p. 7).

Empirical and cognitive knowledge of students

Strong empirical and cognitive knowledge of rural students motivated teachers to use Malay with few restrictions. Based on informal assessment of students made through teachers' regular contact with them, teachers perceived that rural students were unhappy and struggled to learn science through English. This perception left teachers' conscience clear when they willingly compromised the ETeMs policy to enhance student engagement. The findings support the observation made by Giacquinta (1973) that teachers are often affected by how students react to or feel about new ideas. They are likely to resist innovations they perceive students do not like.

Knowledge of educational contexts

Knowledge of educational contexts was another strong influence on teachers' language use. Their working environment which was not supportive and the awareness of teachers from other schools teaching in Malay were reasons for teachers not to use English intensively in their lessons. Knowing that bilingual instruments were still used for assessments besides ongoing discussions about the possibility of repealing the ETeMS policy also affected teachers' seriousness in using English in their instruction. Fullan (2001b) has warned that teachers do not take change seriously unless others indicate that they should.

Knowledge of Educational Ends

Interview data, observation and lesson transcripts revealed that teachers on the whole had three educational ends: to develop students' sight vocabulary of scientific concepts, to cover the syllabus, and to teach to the tests. These educational ends influenced teachers' language use in ways which ran counter to successful implementation of science through English. Focusing on building sight vocabulary of scientific concepts resulted in talk that focused on meaning but not deep understanding or mastery in application of science concepts in communication. Thus, translation became a favoured teaching strategy. Putting importance on completing the syllabus prevented teachers from giving students more time for processing and thinking (Sophia et al., 2010). Instead, rote learning was emphasized. Orienting instruction for examination purposes motivated teachers to encourage more rote learning and unrestricted use of Malay. There appears to be tensions between the MOE's goals and the teachers' goals and practices. The findings support Fullan's (1993a, 2001b) theory that shared vision is important in a change process and that you cannot mandate what matters.

Knowledge/models of teaching

The teachers' language use appears to be largely influenced by three models of teaching: teachers must emphasize memorization of facts, teachers must make learning fun, and teachers must encourage student participation. Since the first is based on the behaviorist theory, much of teacher talk involved drilling and asking students to write copious amounts of notes.

Although all the teachers had knowledge about the need to make learning fun and active, their repertoire appeared limited to translate this knowledge into practice. Drawing and colouring, for example, was perceived as active involvement and fun activity by one of the teachers. She was noted spending a large portion of instructional

time getting students to draw and color regardless of their ability level. As a result, not much of talk related to content or language learning occurred in her classroom. The teacher, instead, was documented disciplining students as they often misbehaved during drawing and coloring activities.

Talk data and observations revealed that the teachers were still dominant in the classroom as instruction still emphasized the transmission of knowledge with hardly any room for meaningful student participation. The teachers' language use which was characteristic of traditional lessons placed teachers as the authority, besides textbooks, for scientific knowledge.

Pedagogical content knowledge

CBI is different from teaching content through L1. Various scholars (de Graaff et al., 2007; Hillyard, 2011) note that teachers need extensive competences to experience success in the CBI classroom. In other words, CBI teachers are expected to develop a high level of pedagogical content knowledge. The teachers in this study offered little evidence that they had developed this. The knowledge bases that teachers had when combined did not indicate that they possess strong pedagogical content knowledge. This seriously affected the teachers' ability to enact meaningful teaching of science through English.

6.3 Conclusions

This section of the chapter will discuss the main conclusions drawn from the findings of the study. It is apt at this juncture to reintroduce the research objectives in order to demonstrate that conclusions drawn validate the objectives of the study:

Research Objectives

1. to investigate the role(s) of language proficiency as a crucial teacher knowledge base when a subject (science) is taught through a second language (English) by the teacher with limited English proficiency (LEP).
2. to discern the knowledge bases that need strengthening in the teacher with limited English proficiency (LEP) for meaningful teaching of science through English to occur in the primary classroom.
3. to examine how teacher talk of teachers with limited English proficiency (LEP) impacts the teaching of science through English in primary classrooms.

6.3.1 Conclusion 1: There is a Case for Language Proficiency as a Significant Teacher Knowledge Base for Implementing Science through English

The analysis of teacher knowledge in this study was based on the model proposed by Turner-Bisset (2001). According to her, there are twelve knowledge bases for expert teaching. This study confirms that all the knowledge bases identified by Turner-Bisset are indeed important variables for effective teaching. In addition, a significant finding that emerged from this study was that proficiency in the language of instruction (English) was a determinant in teacher effectiveness at implementing the intended curriculum. The teacher's language proficiency should be nothing short of good. The three teachers in the sample fell short on this count. This study found that lack of proficiency in English severely undermined teachers' capacity and confidence for enacting the teaching of science through English. In the context of this study, at least, it can be concluded that language proficiency is a crucial knowledge base when a subject is taught through a second language. This researcher therefore suggests that the model of teacher knowledge bases for expert teaching in an ESL/EFL context should include teacher proficiency in the medium of instruction as an additional component as reflected in Figure 6.1.

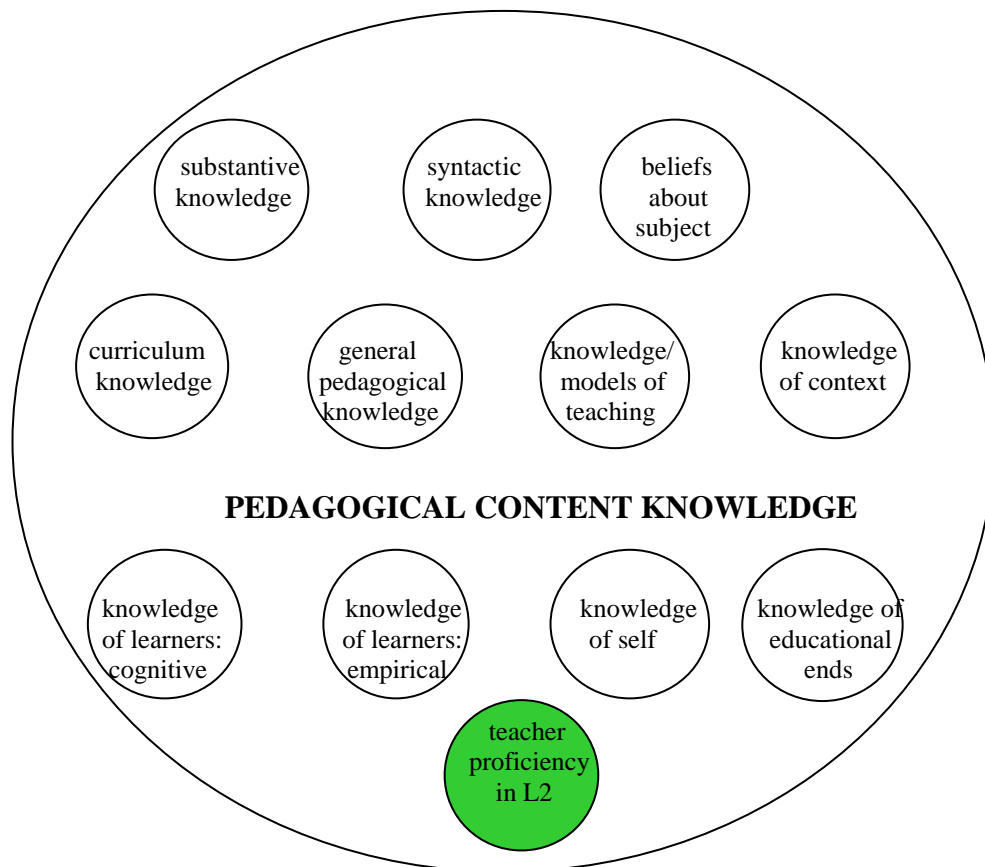


Figure 6.1: A Modified Turner-Bisset (2001) Model: Knowledge Bases for Teaching

6.3.2 Conclusion 2: The Objectives of the Science Curriculum were Superficially Achieved

From the findings it can be objectively concluded that the teachers' readiness for participating in the teaching of science through English reform agenda can only be described as very unsatisfactory, if not distressing. The tremendous influence teacher preparedness has yielded and the far reaching role it has had, has resulted in the non-achievement of most of the objectives of the science curriculum. Teacher preparedness has had a significant contributory role in the failure of the ETeMS policy in this particular rural context. In order to validate this claim the researcher will show how different components of teacher preparedness have impacted the meeting of each objective. Below is the science curriculum. The objectives to be dealt with in the discussion appear in bold:

The science curriculum aims at **producing active learners**. To this end, students are given **ample opportunities to engage in scientific investigations** through hands-on activities and experimentations. **The inquiry approach**, incorporating **thinking skills, thinking strategies** and **thoughtful learning**, should be emphasised **throughout the teaching-learning process** (Ministry of Education, 2002, Preface).

As shown above, the science curriculum includes an initiative to reform science education along current perspectives of teaching and learning intended to engage students more actively in their learning process. However, this study has found that teachers could only realize this in very limited situations because they did not appear to understand the underpinning philosophy of the curriculum; they were unable to deal with the increase in workload it demands; but more importantly, this initiative was difficult to realize because of the high level of teacher knowledge it requires which teachers lacked.

6.3.2.1 Limited Understanding of the Philosophy Underpinning the Science Curriculum

The stated objectives of the science curriculum reflect the nature of science. Trowbridge and Bybee (cited in Laplante, 1997) define science as “a system consisting of a body of knowledge, the process of continuous inquiry that produces that knowledge, and the scientific community of scientists that is engaged in the scientific enterprise” (p. 75). The implication is that the teacher in the science classroom should engage students in activities that scientists do. This involves questioning, examination and explanation (Dickson, 2005). In other words, the teacher must ensure that students come to know how scientific concepts are generated by providing opportunities for them to apply scientific methods.

Teachers who see knowledge as discrete bits of information about a particular subject are likely to perceive student learning as the acquisition of these pieces of information through repetition, memorization and testing of recall (Southwest Educational Development Laboratory, 2002). This is particularly true of one of the teachers who

viewed science as a body of knowledge to be memorized by students. Thus, when students failed to understand or answer questions, they were made to write out the answers repeatedly believing that this helps retention. Furthermore, students were taught to notice keywords to stimulate recall.

The other two teachers were aware that science education encourages active learning through student involvement in hands-on activities and experimentation with the teacher playing the role of facilitator. However, these teachers did not always plan to incorporate such activities in their lessons or knew how to plan meaningful activities. This consequently impacts on how students learn in their classrooms. In general, lessons were still very traditional in its approach with teachers and textbooks being presented as the authority for scientific knowledge. Thus, students usually received transmitted information or watched teacher demonstrations or read their textbooks to learn even abstract concepts. The teachers' instructional practices need to be checked as the mastery of scientific concepts is best achieved through learning to use them in inquiry (Wells, 2008) and through explaining (Lemke, 1998).

6.3.2.2 Inability to Cope with Increase in Workload

All three teachers agreed that scientific activities keep students interested. However, teachers were challenged by their heavy workloads to make such activities constant. Teaching science methods is a time-intensive process, yet time was a resource which teachers lacked. Teaching science to cohorts of different levels, after schools activities, non-academic duties and working in isolation, all left teachers struggling to cope. Fink (2000) cautions that exhausted teachers do not make very effective change agents. The findings of the current study certainly support this view.

6.3.2.3 Inadequate Understanding about Inquiry Approaches

In order to understand the teacher's role in an inquiry-based approach which underpins the science curriculum, it is crucial that one knows its features. The inquiry approach according to the literature (Dickson, 2005; Laplante, 1997) includes the following features:

- Focuses on using and learning content leading to the development of information processing and problem solving skills
- Teacher as facilitator of learning
- Students as learners who co-construct knowledge with teacher and classmates
- Assessment strives to determine progress of skills development and content understanding
- Prepares for life-long learning
- Focuses on “how we come to know”

An effective teacher in the inquiry classroom knows the art of questioning. Unfortunately, in this study the questioning techniques used by teachers did not indicate that they had mastered this art. The teachers' poor choice of questions and questioning strategies made them fail dismally. As in other studies (Glen et al., 2009; Sophia et al, 2010) questions issued by teachers mostly required recall or labelling which did not reflect the inquiry approach. Teachers seemed to overlook the need to develop other thinking skills through application or problem-solving type of activities and questions. Questions associated with these thinking skills are valued because to answer them, students not only have to recall the knowledge received, they also need to sort out the knowledge and apply it, thus, making it their own.

Apart from using questioning strategy, a good advocate of the inquiry approach is one who engages her students in dialogue. The nature of talk in the science classroom must, therefore, be more dialogic than authoritative. One way to achieve this is through the method of dealing with answers (Brualdi, 1998). The teachers in this study provided little evidence to show they were able to generate meaningful dialogue through their follow-ups. Genuine attempts by students were sometimes ignored because teachers were targeting a particular answer. The emphasis on getting the targeted answer without acknowledging the students' attempts to participate confused and frustrated them (Morgan & Saxton, 2006) particularly when answers they offered were not totally irrelevant.

To indicate wrong answers teachers were noted to reissue questions verbatim. In the inquiry classroom, instead of ignoring wrong answers or using verbatim repetition of questions to signal incorrect answers, the teacher is expected to fine-tune initial questions by seeking clarification, that is, comprehensible output (Swain, 1985). In doing this, students are trained the importance of thinking carefully and being precise in their response. After all, CBI classrooms are meant to provide space for students to acquire language skills alongside content learning. Dalton-Puffer (forthcoming) states that negotiating meaning in interaction forces L2 learners to produce comprehensible output and provides them the necessary feedback about mismatches in their production. These are crucial to facilitate their transition from semantic to syntactic processing.

Another strategy used for dealing with incorrect answers was directing a question to another student. This automatically terminated the interaction with the previous student. By not giving the student a second chance the teacher suppresses the student's cognitive processes. Redirecting questions prevented the teacher from handing over the responsibility to the student to find and correct her/his own mistake. This is an

important skill to develop if students are to be prepared for life-long learning. Students must learn to monitor their own learning.

To make talk more dialogic, teachers in this study moved away from the typical IRF pattern by suspending feedback. However, their strategy of suspending feedback by asking Yes/No or either/or questions repeatedly inadvertently, encouraged guessing instead of fine-tuning thinking.

One of the tenets of the inquiry approach is that the teacher should be a good facilitator. A good facilitator of learning is expected to scaffold talk by moving from the less to the more cognitively challenging questions. As a good facilitator, instead of asking for a definition to recall concepts such as *opaque*, *transparent* and *translucent* learnt on a previous day, for example, the teacher could have brought into class a collection of objects for students in groups to sort the objects. Working in groups would enable students to engage in scientific investigations through hands-on activities. As the adage goes, “involve me and I understand”. It also gives them an opportunity to use and recycle the language of science learnt within the lesson. Furthermore, students would be honing their problem-solving skills; all of which are further tenets of the inquiry-based learning. Students can then be asked to justify their sorting. The rest of the class can be asked to comment on the groupings. The students can also be encouraged to provide further examples of each category. This way of learning would be a more meaningful way for the class to revisit the concepts taught. However, this alternative was not considered by the teacher because she came unprepared for the lesson.

6.3.3 Conclusion 3: LEP Teachers in the Primary Setting were poor teachers of Content-based Instruction

The teaching of science through English is a Malaysian version of CBI. According to de Graaff et al. (2007, pp. 13-15), the following are features indicative of effective teaching performance for CBI:

- Teacher facilitates exposure to input at a (just) challenging level
- Teacher facilitates meaning-focused processing
- Teacher facilitates form-focused processing
- Teacher facilitates opportunities for output production
- Teacher facilitates the use of compensation strategies

There is little evidence to indicate the teachers could be considered as effective in the science through English classroom. This perception is based the following findings:

Facilitating exposure to input at a (just) challenging level

In terms of teaching materials, the teachers in this study mainly depended on those provided by the MOE. These resources were sometimes difficult for students to grasp because some of the contents for teaching certain concepts were more realistic to adults rather than for children (Farrugia, 2003). Warrington (2008) attributes the difficulty to the fact that content materials of CBI lessons are frequently adapted from authentic sources and tend to be conceptually and linguistically difficult for language learners. Thus, when teachers such as those in this study made little effort to adapt the materials, students were challenged to make sense of their lessons.

Facilitating meaning-focused processing

Teachers professed that their lessons were meaning-focused and their lesson transcripts did correspond to their perception. Checking students' understanding of new vocabulary items in particular by making requests for meanings occurred frequently. Interestingly, more requests were made to elicit meanings in Malay than in English, the target language. The teachers admitted to placing low priority to learning science contents in English.

Because teachers tended to focus on meaning but had limited linguistic means to explain meaning in English, they frequently relied on translation to facilitate processing. This was evidenced by the high occurrence of reformulations in their talk. According to Warrington (2008), because CBI is not directly language focused and with the majority of Asian EFL contexts being largely monolingual, numerous opportunities are created for students, in the case of this study teachers too, to slip back into their first language.

Facilitating form-focused processing

All three teachers in this study gave very little importance to form-focused talk in their lessons. There are two main reasons for this. Teachers' own assessment of their proficiency in English which was less than good convinced them they were not qualified to facilitate form-focused processing. Observations and lesson transcripts did indeed show them struggling to self-correct their own errors. Teachers' belief about science was the other reason for the lack of attention to linguistic accuracy. In general, all the teachers indicated that the preoccupation in the teaching and learning of science should be the learning of concepts. By holding on to this belief teachers showed high tolerance for errors. Similar observations have been reported by several researchers in other CBI classrooms (Dalton-Puffer, forthcoming; de Graaff et al., 2007). Dalton-Puffer (forthcoming) makes the assumption that since very little explicit language teaching happens in CBI lessons what learners learn or do not learn is directly connected to the conditions of language use that occurred during content teaching. Elsewhere, it has been noted that "Where teachers' own L2 knowledge is not on an acceptable standard for the use of English...their poor usage and knowledge of the language are transferred to the learners" (Stander as cited by Nell & Müller, 2010, p. 637). This was indeed true for all the teachers in this study particularly with regard to faulty pronunciation.

Facilitating opportunities for output production

In presenting various aspects of interactive talk which occurred during CBI lessons, Dalton-Puffer (forthcoming) reported that students' linguistic activities in class were mainly group events through whole-class discussion. In these lessons the teacher always played the leading role. It was estimated that each student's speaking time in a 50-minute lesson was less than 2 minutes. Students mostly spent time being listeners to the teacher's utterances and that of their peers. The observations reported by Dalton-Puffer could well describe the linguistic activities students partook in this study. Data analysed for teacher and student interactions showed that the occurrence of functions such as *directives*, *modelling-drilling* and *display questions* was high. Frequently, students were required to give short verbal responses or none at all as the case was for most *directives*. In this regard, the teachers' facilitation of output production was rather minimal.

Teachers' facilitation of output production was also greatly affected by their tendency to focus on correct answers. The frequent instances of *evaluation* in the teacher talk furnished evidence for this. Inevitably, the talk by the teachers was closely associated with the IRF sequence which is often discouraged (Morgan & Saxton, 2006) for it contributes little to deep understanding and does not press for reflection. It was noted that in the rare instances talk departed from the IRF cycle teachers appeared unprepared to seize the opportunities for content or language learning. It is reasonable, based on the preceding observations, to conclude that teachers' capacity to facilitate opportunities for output production can be at best described as limited. This implies that students' opportunities for extended output were equally restricted.

Facilitating the use of compensation strategies

There does not appear to be sufficient evidence to indicate that teachers were effective facilitators for using compensation strategies promoting the conditions for learning

associated with CBI. In general, teachers relied mostly on code-switching to overcome linguistic problems. Although code-switching has pedagogical utility (Farrugia, 2003), constant switching indirectly signalled to students that it was acceptable not to persevere in learning science through English. The teachers' behaviour it was believed stemmed largely from their limited proficiency in English and also from the belief rural students are not ready to learn science through English. Teachers lowered their expectations for these students by making their own language policy through unrestrictive use of Malay when they could have modelled and facilitated strategy use by other means which could stimulate students' troubleshooting of problems related to comprehension and production. Thus, the rural students who were at a disadvantage at the outset remained behind with no possibility of ever catching up because the teachers did not think they could. But, as Allington (1994) correctly pointed out, "children are more likely to learn what they are taught than what they are not" (p. 1).

6.4 Recommendations

If we take cognizance of the fact that written and oral proficiency cannot be attained overnight and that we have to move on from expedient or ad hoc measures, we need to act on our shortcomings. The recommendations put forward in the following section are based on the findings of the study. The findings the researcher is aware are from a small sample of three lessons, each containing the most amount of teacher talk, taught by three participants all from the same school. The findings derived from such a small sample might not be transferable to other populations. This the researcher accepts. Still, as the researcher opted for a small sample in order to obtain deeper insights, the findings may have relevance for other rural schools in similar contexts and therefore, should be noted.

This section will attempt to provide recommendations that may help to redress the shortcomings raised related to the teacher, the curriculum and assessment, and infrastructure. It would also include recommendations that the MOE may consider introducing to help improve English language proficiency in primary schools.

6.4.1 Redressing Teacher Related Shortcomings

Below are five recommendations to redress teacher related shortcomings:

6.4.1.1 Enhancing Teacher Knowledge

It is indisputable that teacher knowledge is one of the most important elements in determining teacher preparedness for CBI. The findings of this study point to a need to enhance teachers' knowledge in several areas. This is crucial as the combined influence of the knowledge bases has implications on teachers' capacity for developing strong pedagogical content knowledge. The teachers described in this study, in particular, lacked an understanding about the inquiry approach and effective pedagogy for CBI. Therefore, they could not maximize the potential of their lessons to aid student in the learning of content or language. The teachers' knowledge in these areas needs to be further honed for better delivery. An initial step the MOE could take for rural schools such as this one would be to provide "model" lessons for teachers to emulate. Lessons on each topic could be scripted targeting aspects such as the use of accurate English, science terminologies, the incorporation of the inquiry approach pitched at the level appropriate for each standard. These scripts should be then recorded with teaching carried out by proficient experts to demonstrate the application of the scripted lessons and to give teachers images of what successful lessons look like in practice. Prior to the LEP teachers' execution of the lessons an expert needs to go through the lesson highlighting related language features and pedagogical features. After each teaching demonstration session, the expert teacher reviews the lesson taught and helps highlight

strengths and remedy weaknesses. To ensure a permanent reference source the MOE can provide each school master copies of tape scripts and recordings for the school head to make copies. Teachers can then execute lessons based on these resources.

It would be excellent if arrangements can be made to provide teachers with credible mentors at their school during this period. Close supervision of teachers' classroom instruction would help to keep teachers motivated as they try to experiment with new ways of teaching knowing that mentors are at hand to help. The MOE might consider putting in place a mechanism to record teachers' attempts at experimenting with newly gained ideas. This, it is hoped will provide opportunities for first-hand feedback on classroom practice.

Follow-up workshops specifically focusing on the above should be arranged allowing teachers to share their experiences with the wider community of practice. Showing video recordings culled from teachers' attempts to implement reform-oriented lessons during these workshops, it is believed, increases their relevance and is more likely to generate interest. Analyzing classroom practice in these videos may help teachers reflect on their own practice. Engaging teachers in this kind of workshops is likely to encourage them to develop their professional knowledge based on events that actually occur in classrooms. Preferably these workshops can be on a small scale and organized for teachers serving populations sharing similar characteristics. Follow-up meetings can ensue once teachers have been given opportunities to further refine their delivery in the classroom. As face-to-face workshops are costly, alternative methods using ICT is strongly recommended. Online forums can be set up where teachers are able to share success stories, problems faced, instructional ideas and materials.

Mallika Vasugi, in her column *Teacher Talk* in the Sunday Star has this to say:

...I have a dream. That one day teachers will be allowed to fulfill the purpose of their calling. To facilitate the impartation of knowledge, skills and experience. To mould young minds. To educate. To teach (Mallika Vasugi, 2012, p. 9).

In order for this kind of teacher dream to be realized the researcher believes there should be a will by the relevant authorities to provide a climate conducive for optimum teaching and learning. A teacher bogged down by too many non-teaching related responsibilities cannot be expected to be effective in the classroom. Teachers need time to concentrate fully on teaching and learning. A good start therefore would be to exempt teachers from co-curricular activities freeing them to focus on their core business, teaching especially preparation of lessons. This will ensure better prepared and more confident delivery in the classroom.

Teacher collaboration was rather rare in the school in the study. Teacher collaboration is a very useful culture that needs honing. Teachers can be introduced to and shown the concept of lesson scripting, practiced in China and Japan, where teachers collaborate and share ideas for lesson preparations. Teachers take turns to prepare lessons and present their lesson plans explaining the rationale underlying the decisions they make in the preparation of each lesson. Other teachers provide their feedback on the proposed lessons allowing further refinement of the planned lessons before they are executed in the classroom. This is important as building knowledge for teaching requires teachers “to make their personal knowledge become publicly accessible and subject to analysis” (Snow, 2001, p. 3). To add, teachers need to be encouraged to prepare and share teaching aids. School authorities could set up a resource room to store these materials.

6.4.1.2 Enhancing Classroom Delivery

This study has shown that monitoring and follow-up support for teachers who were tasked with teaching science through English seems to be lacking. Monitoring activities

were few and far between and follow-up support from expert mentors hardly available. To show its commitment, the MOE can mobilize its inspectorate to support teachers particularly those who are limited in the medium of instruction and those who are unfamiliar with the CBI approach and may find it problematic as described here. The MOE can find ways to ensure that teachers are supported by credible mentors throughout the difficult period of adjusting their instructional practices. Since teachers are not very good at networking perhaps the MOE could begin by helping them connect with experts in their discipline. Often times, bureaucratic procedures hinder collaboration between teachers and academics from higher educational institutions. The MOE can look into simplifying this process.

6.4.1.3 Providing Assistance to Ensure Better Delivery of Core Business

It is acknowledged that teachers who incorporate hands-on activities and experimentations in their instruction are likely to engage students actively (Smith et al., 2007; Yoon & Onchwari, 2006). In this study, teachers were unable to actively engage all students all the time during science activities as they had concerns about safety issues during these activities. As student numbers for each class were large, attending to students' needs and ensuring their safety at the same time without extra adult assistance was a constant challenge. Additionally, as the school did not have lab assistants the preparations for science activities had to be borne by the teachers who were already not coping. There is, therefore, a pressing need to address this problem. Hiring lab assistants in primary schools should resolve this. In addition to technical support, assistance was also required for dealing with clerical work. Provision of more support staff to take the burden of clerical duties off the teachers should be looked into.

6.4.1.4 Addressing Shortage of Science Teachers

Teachers in the school in the study are expected to teach cohorts of varying levels even in a day due to teacher shortage. This has resulted in poor preparation and poor delivery. The shortage of science teachers in the school is due to the current practice of deploying teachers based on teacher-student ratio, a situation which may be true of many schools in the country. As the findings of this study have shown, refusing requests for additional teachers have grave consequences. Existing teachers are forced to teach more classes than they can cope with. Teachers suffer from stress and fatigue and the quality of lessons also suffers. To ensure quality classroom instruction a rethink of the current teacher deployment practice seems necessary. ETeMS teachers in particular those with limited proficiency in English need special consideration. The burden of having to teach through English can be reduced by controlling the number of levels that each teacher teaches. More concerted effort should be made to deploy more science teachers to schools to help ease the burden.

6.4.1.5 Enhancing Teacher English Language Proficiency

The MOE had in 2007 introduced an English language test for ETeMS teachers. Based on the results, teachers who fell below a certain competence level were required to attend classes to improve their proficiency. Unfortunately, there was no advice on how teachers were to go about this. Consequently, teachers did not feel compelled to take this directive seriously. The MOE may consider formalizing the courses and make it compulsory for teachers to attend. Given teachers' heavy teaching load, it may be necessary for the MOE to compensate for this by giving them time-off rather than having them come at weekends or school holidays. Another alternative would be for the MOE to employ proficient retirees to mentor the teachers.

6.4.2 Redressing Curriculum and Assessment Related Shortcomings

Below are two recommendations to redress curriculum and assessment related shortcomings:

6.4.2.1 Review of the Science Syllabus

Teachers in the study pointed out that the new ETeMS policy changed not only the medium of instruction but also introduced new topics to the syllabus. This resulted in teachers feeling compelled to rush through topics to ensure the completion of the broad syllabus. Wong-Fillmore (1985) points out that teaching science through L2 to students who are learning the language requires time and something has to give. This suggests that streamlining of the science syllabus may encourage teachers to strive for depth. When this occurs learning is conceivably meaningful for the students.

6.4.2.2 Review of Assessment

The study reveals that little adjustment seems to have been made in classroom instruction although the new science curriculum advocates learning through active participation. This could be due partly to the current assessment format. Tests can influence classroom practice tremendously (Berry & McNeil, 2005). The findings show that the present test format which focuses on content mastery has considerable impact on the methodology teachers used in their teaching. Teachers, in general, were still inclined to focus on rote learning instead of emphasizing new instructional strategies which promote meaningful learning. Journaling and simple science projects which encourage active learning using various resources and skills were not explored because the current assessment method does not give weight to such endeavours. There are some indications that the current assessment method seems to be stopping teachers from experimenting with reform-oriented teaching methods. This suggests a need to review

the assessment format to include the adoption of cumulative assessment such as keeping journals and doing science projects. This is hoped to encourage a washback effect on teachers to try new methodologies.

6.4.3 Redressing Infrastructure Related shortcomings

Below are some recommendations to redress infrastructure related shortcomings:

6.4.3.1 Monitoring Delivery and Maintenance of Supplies

Having well-conceived infrastructure in place is crucial for motivating and for supporting the teaching of science through English. The MOE on the onset was quick to promise measures to prepare teachers and schools but it appears that fulfilling their promises has not been in tandem. There seems to be a need for the MOE to improve its delivery system in relation to procurement of equipment, apparatus and other materials. The MOE might consider engaging in continuous communication with schools to ensure that supplies are delivered and in cases involving information technology, installed promptly.

Equally important in preparing teachers for their work is the MOE's commitment to ensuring that all equipment provided function at all times. The MOE has equipped schools with information technology to aid teachers in their work. More attention now could perhaps be given to scheduled maintenance to look into wear and tear and replacement of equipment. A well-conceived maintenance culture should be given greater emphasis than there currently is to ensure that money invested continues to be money well spent.

Since the MOE appears to be challenged in managing monitoring and maintenance on its own, it is recommended that it considers joining forces with the corporate sector. The

MOE could enlist the support of big corporations as part of their corporate social responsibility to fund, equip and maintain school computer rooms.

6.4.3.2 Setting Up Good Science Labs, Science Resource Rooms and Libraries

The researcher discovered that science experiments were conducted not in a science lab but in a very small, poorly-equipped science room with six tables forcing students to cramp around each. Consequently, teachers had to forgo certain experiments. On some occasions, when experiments were conducted, a lot of time was wasted as students had to wait their turn resulting in lessons ending with no proper discussion and closure. Therefore, well-equipped and well-designed science labs are imperatives for better teaching and learning.

Apart from the need for science labs, the school may look into designating a room for science teaching aids. Presently, preparing teaching aids seems to be low priority with the teachers as the science room cum lab is often used by different teachers teaching different levels and topics. Teaching aids prepared cannot be left behind or go missing. With a proper designated science room, teachers are likely in their own time prepare teaching aids which they can store in this room and use when needed. More importantly, a culture of setting up a bank of teaching aids could be nurtured with each teacher contributing something towards it enabling the sharing of teaching aids amongst them. This room could also include science reference books and a computer with internet access to help teachers broaden their content knowledge as well as in preparing teaching materials.

With the standard of English being so poor, and the school enrolment made up of the rural poor, the MOE should make a concerted effort to raise the level of English of the students and teachers to help them to cope with their science through English lessons

and to get access to knowledge through books and other information retrieval resources. A well-equipped library cum audio-visual room might be the solution to address the problem. Cupboard libraries in classrooms of old could be reintroduced.

6.4.4 Raising English Proficiency for Successful Teaching and Learning through ETeMS

Based on the findings of this study, three recommendations are provided to raise English proficiency for successful teaching learning through ETeMS. These are presented below:

6.4.4.1 Ensure Optimum Use of English Language Lessons

When the government decided to reverse the ETeMS policy, it hoped to raise English language proficiency levels by increasing the number of contact hours for English in schools. However, extra hours for English language lessons would not make much difference in enhancing English language development if poor quality teachers continue to lead students. Increased hours will not amount to much if teachers continue to be denied the support they require. Measures should be taken to optimize the potential of English lessons by providing continuous well-conceived professional development for teachers. They can also be supported by providing the human and material resources perceived as lacking currently.

The MOE ought to look into curriculum review of the primary school English language syllabi which appear to be pitched too low as an additional measure to optimize English lessons. If concerted effort is made by curriculum designers to allow for the English syllabi to complement the science syllabi, ensuring especially that incremental development works together, the main beneficiary will be the disadvantaged poor rural student. Fears about children being unable to cope are baseless as observations suggest otherwise. The students were alert and occasionally willing when their interest was

aroused. And if teacher proficiency and inefficient infrastructure issues are addressed now, the rural child it is believed will be allowed to rise to greater heights.

6.4.4.2 Maintain the ETeMS Policy

Having witnessed the various weaknesses in the science through English classrooms, it is clear that for the majority of the students in this study, learning science through English was an uphill struggle. However, it is believed that ETeMS should be allowed to continue as it is a good solution to the English language problems facing the nation. If the government endeavours to overcome the weaknesses highlighted in this study, all schools, even the rural ones, at some point in the future would be able to ease the transition to university for those intending to do so. As pointed out by the teachers in the study, many rural students have limited exposure to English. Many do not have the opportunity to have tuition to help them develop their English language. They live in a Malay-speaking community. If more stringent rules on English are imposed on our students in the future, the rural students would likely stand to lose the most. If the day comes when the public sector is no longer able to absorb unmarketable graduates who cannot speak or write English, the bulk is likely to comprise individuals from this same group. Keeping the ETeMS policy could ensure that the rural students are not consigned to a bleak future as they would have an alternative and a chance to develop their English proficiency while they are in school.

6.4.4.3 Enhancing Language Teacher Base

In its effort to improve English proficiency in schools, the MOE has requested for 300 Fulbright scholars from the United States to teach English at selected Malaysian schools in urban and rural areas (Sathasivam, 2011). While nobody denies that native speaker teachers are likely to provide English language input that is rich, the MOE must be

mindful that this strategy too has its own shortcomings. Berry and McNeil (2005) when reviewing literature on native and non-native speaker teachers pointed out “that teachers who speak their students’ mother tongue are generally more accurate in pinpointing sources of language difficulty for their learners than teachers who are not familiar with learners’ first language” (p. 383). For this reason, the MOE should consider looking to its own shores for solutions to the nation’s English language problems. The MOE may consider inviting participants from the corporate sector to adopt a rural primary school as part of their corporate social responsibility. Each company takes corporate responsibility to fund three reliable retiree teachers to teach and mentor teachers in its adopted school. One of these expert veterans is solely responsible to run English classes for mathematics and science teachers while the other two can look into assisting teachers with enhancing their pedagogical content knowledge.

Another strategy to improve English language skills would be for the government to be more stringent with the English language requirement in the selection of candidates for tertiary education, in particular, candidates for TESL programmes. The reason for this is best explained by Sathasivam (2011, p. 41):

The Ministry of Education must bear in mind that learning English should start with the primary schools, to lay the foundation in ensuring proper usage of grammar, writing skills and accuracy in spelling and sentence construction. We have seen that in teaching English language the methodology is flawed at the primary school level, with no proper grounding in the language. The students move into secondary school and later enter university with a credit or with MUET band 2. We are compromising on the entrance requirement and universities are churning out mediocre graduates in English. The English graduates become language teachers who are unable to speak well or use proper English. The vicious cycle continues, for teachers of tomorrow come from the class of today.

Students are likely to be more serious about learning English if they know it is their gateway to their chosen careers. Furthermore, a proficient candidate for TESL programmes is probably easier to train and is perhaps worth more than three non-proficient ones.

6.5 Suggestions for Further Research

The findings of this study were based on data collected through purposive sampling procedure which involved a small sample size. Thus, the findings are not meant to be transferable to other populations. In order to gain more information and insights into teachers' language proficiency and knowledge bases in CBI classrooms, this study can be replicated in a larger study in other rural schools made up of a similar or mixed racial composition at the primary and secondary school levels. Further research might investigate teacher preparedness and teacher-student interactions in science classrooms or other subjects in urban and semi-urban schools to uncover issues pertinent to these locales.

In this study, the use of audio recording and observation could not accurately and fully capture the way teachers used English and Malay. It is recommended that future investigations incorporate the use of video recording to assist recall and to minimize loss of data.

Participant attrition posed a threat to data collection during the study. It was a problem which the researcher did not foresee happening and hence, had not prepared for. In order to minimize the effects of attrition in future research it is advisable to cast the net wider during the recruitment stage as it is certainly better to start with a big sample rather than a small one. To lessen or prevent loss of participants, it is recommended for the researcher to enhance positive participant attitudes towards the study. The researcher should try to make participants see that their time and contribution to the study is valued and worthwhile. To achieve this, non-face threatening feedback about teachers' classroom performance and pointers on how it can be improved can be shared on a regular basis either orally or in writing. The researcher could also develop strong

informal bonds with participants outside of the study setting which could help enhance their continued participation in the study.

One goal in teaching science and mathematics through the medium of English was to improve the standard of English usage in Malaysia by giving students, especially those in areas where English has no immediate or local function as in the rural areas, a real and current use for English. This goal presupposes that regular English teaching and the English acquired through use of English in the science and mathematics classes both complement each other in improving the student's command of English. The findings of the current study raise a number of doubts about the wisdom of making such assumptions. It is therefore recommended that future research can be conducted to compare the content and goals of regular English classes and what these empower the student to accomplish in English and the language demands that regular science and/or mathematics teaching and learning entail.

6.6 Concluding Remarks

This qualitative study which investigates three LEP science teachers' knowledge bases for teaching science through English reveals that with inadequate teacher preparation and professional development, teachers are resorting to fast and easy solutions to new and complex instructional approach. These solutions, as this study has shown, could not contribute to meaningful teaching and learning conditions as the teachers failed to develop an adequate understanding of the objectives and the basic principles of the new approach. The fact that teachers were not committed to develop their professional knowledge suggests that teachers are not receptive to change imposed by others. The fact that teachers put little effort to examine their work suggests that they lack the attitudes which would facilitate the achievement of students who depend on them to scaffold their learning. The fact that teachers lacked resourcefulness in overcoming

some of the problems they faced suggests that they are not ready to work independently and should therefore not be left to work in isolation. The fact that teachers raised several issues with regard to the school infrastructure and culture besides their desire for more time and assistance to focus on teaching suggests that the present school system is not supportive of teachers' work. The study, although based on a small sample, share commonalities in terms of issues and findings with previous work in this field (Sophia et al., 2010; Tan, 2011). The researcher, therefore, is convinced that the lessons learnt in this study would be valuable insights to others who are embarking on or have already embarked on similar content-based instruction projects.

BIBLIOGRAPHY

- Abu Bakar, H. (2006). *Persepsi guru terhadap perubahan pengajaran dan pembelajaran Sains dan Matematik dalam bahasa Inggeris*. Unpublished M. Linguistics. thesis, Universiti Malaya, Kuala Lumpur.
- Ahern, K., & Le Brocque, R. (2005). Methodological issues in the effects of attrition: Simple solutions for social scientists. *Field Methods*, 17(1), 53-69.
- Akerson, V. L. (2005). How do elementary teachers compensate for incomplete Science content knowledge? *Research in Science Education*, 35(2-3), 245-268.
- Alemu, D. S., & Tekleselassie, A. A. (2006). Instructional language policy in Ethiopia: Motivated by politics or the educational needs of children? *Planning and Changing*, 37(3-4), 151-168.
- Alis, P. (2006). *Language and nation building: A study of the language medium policy in Malaysia*. Petaling Jaya: SIRD.
- Allington, R. L. (1994). The schools we have, the schools we need. *Reading Teacher*, 48(1), 14-29.
- Ambigapathy, P., & Revathi, R. (2003). *Mathematics and science in English: Teacher voice*. Paper presented at the ELTC ETeMS Conference 2003: Managing Curricular Change, Kuala Lumpur, 2-4 December.
- Anderson, S. (2002). Working together to develop a professional learning community. *HERSDA*, 20-27.
- Anonymous (2006, 16 August). Teachers lacking in skills. *New Straits Times*, p. 22.
- Archer, J. (2000). *Teachers' beliefs about successful teaching and learning in English*. Paper presented at the Australian Association for Research in Education, University of Sydney, Australia, 4-7 December.
- Azirah, H. (2009). Not plain sailing: Malaysia's language choice in policy and education. *AILA Review*, 22, 36-51.
- Baker, C. (2001). *Foundations of bilingual education and biligualism* (3rd ed.). Clevedon, England: Multilingual Matters Ltd.
- Balkis, A. (2004). *Reaction of teachers towards the policy of teaching of science and mathematics in the English language: A survey of some schools in the district of Shah Alam*. Unpublished M. Ed. thesis, Universiti Malaya, Kuala Lumpur.
- Ball, D. L. (1991). What's all this talk about "discourse"? *The Arithmetic Teacher*, 39(3), 44-48.
- Bandura, A. (1997). *Self-Efficacy the exercise of control*. New York: W. H. Freeman and Company.

- Barton, J. (1995). Conducting effective classroom discussions. *Journal of Reading*, 38(5), 346-350.
- Beane, D. B. (1988). *Mathematics and science: Critical filters for the future of minority students*. The Mid-Atlantic Equity Center: The American University.
- Belchetz, D., & Leithwood, K. (2007). Successful leadership: Does context matter and if so, how? In C. Day & K. Leithwood (Eds.), *Successful principal leadership in times of change*. Dordrecht: Springer.
- Berliner, D. C. (1987). Ways of thinking about students and classrooms by more and less experienced teachers. In J. Calderhead (Ed.), *Exploring Teachers' Thinking*. London: Cassell Educational Limited.
- Berliner, D. C., Stein, P., Sabers, D., Clarridge, P. B., Cushing, K., & Pinnegar, S. (1988). Implications of research on pedagogical expertise and experience for mathematics teaching. In D. A. Grouws, T. J. Cooney & D. Jones (Eds.), *Effective Mathematics Teaching* (pp. 67-95). Reston, Virginia: Lawrence Erlbaum Associates.
- Berry, V., & McNeil, A. (2005). Raising English language standards in Hong Kong. *Language Policy*, 4(4), 371-394.
- Bisschoff, T. (2009). Mandated change gone wrong? A case study of law-based school reform in South Africa. *International Journal of Educational Management*, 23(4), 336-347.
- Bolander, I. (2008). Code-switching in the classroom: A sign of deficiency or a part of the learning process? Unpublished B.Ed. thesis, Karlstad University, Sweden.
- Borsuk, A. J. (2003, 6 October). Bottom line for math students: Good teaching is what counts. *Milwaukee Journal Sentinel*, p. 2.
- Boulton, D., & Hammersley, M. (1996). Analysis of unstructured data. In R. Sapsford & V. Jupp (Eds.), *Data collection and analysis*. Thousand Oaks, California: SAGE Publications.
- Brenner, M. E. (1998). Development of mathematical communication in problem solving groups by language minority students. *Bilingual Research Journal*, 22(2), 103-128.
- Brice, A. (2001). Choice of languages in instruction. *Teaching Exceptional Children*, 33(4), 10-16.
- Brown, R., & Hirst, E. (2007). Developing an understanding of the mediating role of talk in the elementary mathematics classroom. *Journal of Classroom Interaction*, 41-42(2-1), 18-28.
- Brualdi, A. C. (1998). Classroom questions. *Practical Assessment, Research & Evaluation* 6(6), Retrieved 3 September 2005, from <http://PAREonline.net/getvn.asp?v=6&n=6>

- Bucuvalas, A. (2003, 1 February). Teaching students to be good teachers. *HGSC News*.
- Burns, C., & Myhill, D. (2004). Interactive or inactive? A consideration of the nature of interaction in whole class teaching. *Cambridge Journal of Education*, 34(1), 35-49.
- Cadorath, J. and S. Harris (1998). Unplanned classroom language and teacher training. *ELT Journal*, 52(3), 188-196.
- Calderon, M., Slavin, R., & Sanchez, M. (2011). Effective Instruction for English learners. *The Future of Children*, 21(1), 103-127.
- Cammarata, L. (2010). Foreign language teachers' struggle to learn content-based instruction. *L2 Journal*, 2, 89-118.
- Canale, M., & Swain, M. (1979). *Communicative approaches to second language teaching and testing*. Toronto: Ministry of Education.
- Caram, C. A., & Davis, P. B. (2005). Inviting student engagement with questioning. *Kappa Delta Pi Record*, 42(1), 18-24.
- Carless, D. R., (1997). Managing systematic curriculum change: A critical analysis of Hong Kong's target-oriented curriculum initiative. *International Review of Education*, 43(4), 349-366.
- Carlson, C. (2000). Science literacy for all. *The Science Teacher*, 67(3), 48-52.
- Carrier, K. A. (2005). Supporting science learning through science literacy objectives for English language learners. *Science Activities*, 42(2), 5-11.
- Cazden, C. B. (1988). *Classroom discourse*. Portsmouth, NH: Heinemann.
- Cazden, C. B. (2001). *Classroom discourse* (2nd ed.). Portsmouth, NH: Heinemann.
- Chan, Y. W., Gill, R. S., Karuppiyah, S., Ponnudurai, J. P., Thomas, M., Norlia, S., et al. (n.d.). The teaching of science and mathematics in English (ETeMS) modules *English Language Teaching Centre*, Retrieved 26 November 2004, from <http://www.tutor.com.my/tutor/etems/index.asp?pp=main2.htm>
- Chella. (2009, 12 July). Poor English a result of the system. *Sunday Star*, p. N29.
- Chew, V. (2008, 7 September). Teachers' English poor. *Sunday Star*, p. N12.
- Chick, J. K. (1996). Safe-talk: Collusion in apartheid education. In H. Coleman (Ed.), *Society and the language classroom*. Cambridge: Cambridge University Press.
- Chih-en, H. (n.d.). Strengths and weaknesses of qualitative case study research. Retrieved 2 December 2012 from http://survey.sinica.edu.tw/serial/fulltext/is/p87_116.pdf
- Chin, C. (2007). Teacher questioning in science classrooms: Approaches that stimulate productive thinking. *Journal of Research in Science Teaching* 44(6), 815-843.

- Chin, C., & Langsford, A. (2004). Questioning students in ways that encourage thinking. *Teaching Science*, 50(4), 16-21.
- Chok, S. L. (2007, 23 December). Highs and lows of the teaching fraternity. *New Sunday Times*, p. 20.
- Chooi, C. (2009, 19 July). PPSMI not good for rural kids. *The Star*. Retrieved 4 August 2009, from <http://thestar.com.my/education/story.asp?file=2009/7/19/education/434590&sec=education>.
- Choong, K. F. (2003). *English for the teaching of mathematics and science (ETeMS): From concept to implementation*. Paper presented at the ELTC ETeMS Conference 2003: Managing Curricular Change. Kuala Lumpur, 2-4 December.
- Chrispeel, J. H., Andrews, C. A., & Gonzalez, M. (2007). System supports for teacher learning and school improvement. In T. Townsend (Ed.), *International handbook of school effectiveness and improvement* (pp. 787-806). Dordrecht, Netherlands: Springer.
- Chun, A. E., Day, R. D., Chenoweth, N. A., & Luppescu, S. (1982). Errors, interaction, and corrections: A study of native-non-native conversations. *TESOL Quarterly*, 16(4), 537-547
- Civikly, J. M. (1997). *Classroom communication: Principles and practice*. New York: Primis Custom Publishing.
- Clark, C. M. (1992). Self-directed professional development in understanding teacher development. In A. Hargreaves & M. G. Fullan (Eds.), *Understanding teacher development* (pp. 77-84). New York: Teachers College Press.
- Cohen, D. K., & Ball, D. L. (2001). Making change: Instruction and its improvement. *Phi Delta Kappan*, 83(1), 73-77.
- Collier, V. P. (1989). How long? A synthesis of research on academic achievement in a second language. *TESOL Quarterly*, 23(3), 509-530.
- Concerned Observer (2007, 7 June). Is this the way to teach science? *The Star*, p. T8.
- Cornell, C. (1999). "I hate math! I couldn't learn it, and I can't teach it!" *Childhood Education*, 75(4), 225-230.
- Costa, F., & D'Angelo, L. (2011). CLIL: A suit for all seasons. *Latin American Journal of Content & Language Integrated Learning*, 4(1), 1-13.
- Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, California: SAGE Publications.
- Croll, P., Abbott, D., Broadfoot, P., Osborn, M., & Pollard, A. (1994). Teachers and education policy: Roles and models. *British Journal of Educational Studies*, XXXXII(4), 333-347.

- Cummins, J. (2001). Linguistic interdependence and the educational development of bilingual children. In C. Baker & N. H. Hornberger (Eds.), *An introductory reader to the writings of Jim Cummins* (pp. 63-95). Clevedon, UK: Multilingual Matters Ltd.
- Cummins, J., & Man, E. Y. F. (2007). Academic language: What is it and how do we acquire it? In J. Cummins & C. Davison (Eds.), *International Handbook of English Language Teaching* (pp. 797-810). Norvell: Springer Publication.
- Cummins, J., & Swain, M. (1986). *Bilingualism in education*. New York: Longman.
- Curtain, H., & Pesola, C. A. B. (1994). *Languages and children* (2nd ed.). White Plains, N.Y.: Longman.
- Dalton-Puffer, C. (2011). Content and language integrated learning- from practice to principles? *Annual Review of Applied Linguistics*, 31, 182-204.
- Dalton-Puffer, C. (Ed.). (forthcoming). *Outcomes and processes in content and language integrated learning (CLIL): Current research from Europe*. Heidelberg: Carl Winter.
- Darling-Hammond, L. (1990). Instructional policy into practice: "The power of the bottom over the top". *Educational Evaluation and Policy Analysis*, 12(3), 339-347.
- Darling-Hammond, L. (2000). *Solving the dilemma of teacher supply, demand, and standards: How we can ensure a competent, caring, and qualified teacher for every child*, Retrieved 21 July 2010, from <http://ericfac.piccard.cac.com>.
- Davis, J. S. (1914). The framing of questions. *The young teacher's primer*. London: Blackie and Son Limited.
- Davis, S., Darling-Hammond, L., LaPointe, M., & Meyerson, D. (2005). *School leadership study: Developing successful principals (Review of Research)*. Stanford, CA: Stanford University, Stanford Educational Leadership Institute.
- de Graaff, R., Koopman, G. J., Westhoff, G. and Utrecht (2007). Identifying effective L2 pedagogy in content and language integrated learning (CLIL). *Vienna English Working Papers*, 16(3), 12-19.
- De Guzman, A. B. (2006). Reforms in Phillipine basic education viewed from key elements of successful school-based management (SBM) schools. *Educational Research for Policy and Practice*, 5(1), 55-71.
- Denny, J. T. (2001). Development of a national language in Malaysia. *Electronic Magazine of Multicultural Education* 3(1), 1-11. Retrieved 4 June 2004, from <http://www.eastern.edu/publications/emme/2001spring/denny.html>
- Dewey, J. (1991). From the concrete to the abstract. In D. Pimm & E. Love (Eds.), *Teaching and learning school mathematics*. London: The Open University.

- Dickson, V. (2005). The nature of student and teacher discourse in an elementary classroom. *Curriculum and Teaching Dialogue*, 7(1-2), 109-122.
- Dillon, J. T. (1978). Using questions to depress student thought. *The School Review*, 87(1), 50-63.
- Din, Y. Y., Tsang, W. K., & Cheung, S. P. (2003). Evaluation of the effects of medium of instruction on the science learning of Hong Kong secondary students: Performance on the science achievement test. *Bilingual Research Journal*, 27(2), 295-330.
- Dong, Y. R. (2004-2005). Getting at the content. *Educational Leadership*, 62(4), 14-19.
- Doraisamy, R. J. (2012). *The impact of English as medium of instruction on the academic performance of second language learners in the further education and training band at schools in KwaZulu-Natal*. Unpublished doctoral dissertation, Durban University of Technology.
- Duff, P. A., & Polio, C. G. (1990). How much foreign language use is there in the foreign language classroom? *The Modern Language Journal*, 74(2), 154-166.
- Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review*, 14(4), 532-550.
- Elder, L., & Paul, R. (1998). The role of socratic questioning in thinking, teaching, and learning. *Clearing House*, 71(5), 297-301.
- Ellis, R. (1985). *Understanding second language acquisition*. Oxford: Oxford University Press.
- Ellis, R. (1997). *Second language acquisition*. Oxford: Oxford University Press.
- Ellis, R., Basturkmen, H., & Loewen, S. (2001). Learner uptake in communicative ESL lessons. *Language Learning*, 51(2), 281-318.
- Eskey, D. E. (1997). Syllabus design in content-based instruction. In M. A. Snow & D. M. Brinton (Eds.), *The content-based classroom: Perspectives on integrating language and content*. White Plains, N. Y.: Longman.
- Evans, R. (1996). *The human side of school change: Reform, resistance, and the real-life problems of innovation*. San Francisco: Jossey-Bass.
- Ezeife, A. N. (2003). Using the Environment in Mathematics and Science Teaching: An African and Aboriginal Perspective. *International Review of Education*, 49(3-4), 319-342.
- Farrugia, M. T. (2003). The use of English as a medium of instruction in Maltese mathematics classrooms: Continuing the debate. *Journal of Maltese Education Research*, 1(2), 1-14.

- Fennema-Bloom, J. (2008). *Pedagogic code-switching: A case study of the language practices of three bilingual content teachers*. Unpublished doctoral dissertation Teachers College of Columbia University, New York.
- Finger, G., & Houget, B. (2009). Insights into the intrinsic and extrinsic challenges for implementing technology education: Case studies of Queensland teachers. *International Journal of Technology and Design Education*, 19(3), 309-334.
- Fink, D. (2001). Two solitudes: Policy makers and policy implementers. In M. Fielding (Ed.), *Taking education really seriously: Three years of hard labour*. London: Routledge-Falmer.
- Fink, D. (2003). The law of unintended consequences: The 'real' cost of top-down reform *Journal of Educational Change*, 4(2), 105-128.
- Foster, P. (1996). In R. Sapsford & V. Jupp (Eds.), *Data collection and analysis* (pp. 57-93). Thousand Oaks, California: Sage Publications.
- Fraenkel, J. R., & Wallen, N. E. (1990). *How to design and evaluate research in education*. New York: McGraw-Hill.
- Freeman, D. (1996). *Doing teacher research: From inquiry to understanding*. New York: Heinle & Heinle Publishers.
- Fullan, M. (1993a). *Change forces: Probing the depths of educational reform*. London: The Falmer Press.
- Fullan, M. (1993b). Why teachers must become change agents. *Educational Leadership*, 50(6), 1-11.
- Fullan, M. (2001a). Implementing change at the building level. Retrieved 4 October 2007, from http://www.michaelfullan.ca/Articles_01/08_01.htm
- Fullan, M. (2001b). *The new meaning of educational change* (3rd ed.). New York: Teachers College Press.
- Fullan, M. (2002). Principals as leaders in a culture of change. *Educational Leadership* (Special issue), 1-15.
- Fullan, M. (2003). *Change forces with a vengeance*. London: RoutledgeFalmer.
- Fullan, M. (2005). Professional learning communities writ large. In R. Dufour, R. Eaker, R. Dufour (Eds.), *On common ground* (pp. 209-223). Bloomington, Indiana: National Education Service.
- Fullan, M. (2008). *The six secrets of change*. San Francisco: Jossey-Bass.
- Gall, M. D. (1970). The use of questions in teaching. *Review of Educational Research*, 40(5), 707-721.
- Galloway, C. G., & Mickelson, N. I. (1973). Improving teachers' questions. *The Elementary School Journal*, 74(3), 145-148.

- Gee, J. P. (2001). Language in the science classroom: Academic social languages as the heart of school-based literacy. In E. W. Saul (Ed.), *Crossing borders in literacy and science instruction: Perspectives in theory and practice* (pp. 13-32). Newark, DE: International Reading Association/National Science Teachers Association.
- Gee, J. P. (2008). What is academic language? In A. Rosebery & B. Warren (Eds.), *Teaching science to English language learners* (pp. 57-70). Arlington, VA: National Science Teacher Association.
- Genesee, F. (1994). *Integrating language and content: Lessons from immersion*. National Center for Research on Cultural Diversity and Second Language Learning, Washington, D.C.: Centre for Applied Linguistics.
- Giacquinta, J. B. (1973). The process of organizational change in schools. *Review of Research in Education, 1*, 178-208.
- Gibbons, P. (1993). *Learning to learn in a second language*. Portsmouth, NH: Heinemann.
- Gibbons, P. (2002). *Scaffolding language scaffolding learning*. Portsmouth, NH: Heinemann.
- Gill, S. K. (2002). *English language challenges for Malaysia: International communication*. Serdang, Selangor: Universiti Putra Malaysia Press.
- Gill, S. K. (2004). Medium-of-Instruction policy in higher education in Malaysia: Nationalism versus internationalization. In J. W. Tollefson & A. B. M. Tsui (Eds.), *Medium of instruction policies: Which agenda whose agenda?* (pp. 135-152). Mahwah, New Jersey: Lawrence Erlbaum Associates.
- Gillies, R. M., & Boyle, M. (2006). Ten Australian elementary teachers' discourse and reported pedagogical practices during cooperative learning. *The Elementary School Journal, 106*(5), 429-451.
- Glen, N. J., & Dotger, S. (2009). Elementary teachers' use of language to label and interpret science concepts. *Journal of Elementary Science Education, 21*(4), 71-83.
- Goldenberg, C. (2008). Teaching English language learners: What the research does and does not say. *American Educator*. Washington, D. C.: American Educator.
- Good, T. L., & Brophy, J. E. (1973). *Looking in classrooms*. New York: Harper & Row.
- Good, T. L., & Brophy, J. E. (2000). *Looking in classrooms* (8th ed.). New York: Longman.
- Goodnough, K. (2008). Moving science off the "back burner": Meaning making within an action research community of practice. *Journal of Science Teacher Education, 19*(1), 15-39.

- Grabe, W., & Stoller, F. L. (1997). Content-based instruction: Research foundations. In M. A. Snow & D. M. Brinton (Eds.), *The content-based classroom: Perspectives on integrating language and content* (pp. 5-21). New York: Longman.
- Grossman, P. L. (1990). *The making of a teacher: Teacher knowledge and teacher education*. New York: Teacher College Press.
- Groundwater-Smith, S., & Kemmis, S. (2004). *Knowing makes the difference: Learnings from the NSW Priority Action School Program*. New South Wales Department of Education and Training. Retrieved 4 July 2009, from <http://www.det.nsw.edu.au/reviews/pasp/index.htm>.
- Groundwater-Smith, S., Brennan, M., McFadden, M., & Mitchell, J. (2001). *Secondary schooling in a changing world*. Sydney: Harcourt.
- Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher*, 15(5), 5-12.
- Gustafson, B., Guilbert, S., & MacDonald, D. (2002). Beginning elementary science teachers: Developing professional knowledge during a limited mentoring experience. *Research in Science Education*, 32(3), 281-302.
- Hamayan, E. V., & Tucker, G. R. (1980). Language input in the bilingual classroom and its relationship to second language achievement. *TESOL Quarterly*, 14(4), 453-468.
- Hansford, C. (1988). *Teachers and classroom communication*. Sydney: Harcourt Brace Jovanovich.
- Hariati, A. (2007, 5 August). One week at a time. *The Star*, pp. E18, E19.
- Harper, C., & de Jong, E. (2004). Misconceptions about teaching English-language learners. *Journal of Adolescent & Adult Literacy*, 48(2), 152-162.
- Hart, J. E., & Lee, O. (2003). Teacher professional development to improve the science and literacy achievement. *Bilingual Research Journal*, 27(3), 475-501.
- Hashweh, M. Z. (1987). Effects of subject-matter knowledge in the teaching of biology and physics. *Teaching and Teacher Education*, 3(2), 109-120.
- Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational Researcher*, 31(5), 3-15.
- High pass rates in science, maths. (2005, 23 December). *New Straits Times*, p. 5.
- Hill, H. C. (2007). Learning in the teaching workforce. *The Future of Children*, 17(1), 111-127.
- Hillyard, S. (2011). First steps in CLIL: Training the teachers. *Latin American Journal of Content & Language Integrated Learning*, 4(2), 1-12.

- Hogan, T., Rabinowitz, M., & Craven, J. A. (2003). Representation in Teaching: Inferences from Research of Expert and Novice Teachers. *Educational Psychologist*, 38(4), 235-247.
- House, J. D. (2003). Instructional activities and interest in science learning for adolescent students in Japan and the United States: Findings from the Third International Mathematics and Science Study (TIMSS). *International Journal of Instructional Media*, 30(4), 429-442.
- Hu, G. (2009). The craze for English-medium education in China: Driving forces and looming consequences. *English Today*, 25(4), pp. 47-54.
- Husna, Y. (2009, 9 July). It's back to BM. *The Sun*, pp. 1, 2.
- Husna, Y. (2009, 10 July). Quality of professionals won't be affected. *The Sun*, p. 1.
- Incentives for headmasters to be paid immediately. (2011, 1 March). *The Sun*, p. 2.
- Isahak, H., Abdul Latif, G., Md Nasir, M., Abdul Halim, I., & Mariam, M. N. (2008). The effects of using English as the medium of instruction for mathematics and science in primary school. Retrieved 6 June 2009 from http://www.nst.com.my/Current_News/NST/Sunday/Frontpage/20080907091738/Article
- Ismail, A. A. (2007). Guru pakar enggan ke Felda punca pelajaran merosot- MB. *Utusan Malaysia*. Retrieved 13 August 2007, from http://www.utusan.com.my/utusan/archive.asp?y=2007&dt=3021&pub=Utusan_Malaysia&sec=Dalam_Negeri&pg=dn_07.htm
- Jamaludin, J. (n.d.). Persidangan Meja Bulat 4 PPSMI. Retrieved 23 July 2009, from <http://www2.uitm.edu.my/drjj/>
- Janks, H., & Sethole, M. P. (2006). Reaching out and reaching in: "We had to develop ourselves before we could be developed". In K. Cooper & R. White (Eds.), *The Practical Critical Educator*. Dordrecht: Springer.
- Jefferson, G. (1979). In G. Psathas (Ed.), *Everyday language studies in ethnomethodology* (pp. 79-96). New York: Irvingston Publisher.
- Jeffrey, B., & Woods, P. (1996). Feeling deprofessionalised: The social construction of emotions during an OFSTED inspection. *Cambridge Journal of Education*, 26(3), 325-343
- Jenlink, P. M., Reigeluth, C. M., Carr, A. A., & Nelson, L. M. (1998). Guidelines for facilitating systemic change in school districts. *Systems Research and Behavioral Science*, 15(3), 217-233.
- John, G. (2004). What is a case study and what is it good for? *The American Political Science Review*, 98(2), 341-354.
- Johnson, D. (2002). New twists for the old language issue. Retrieved 25 August 2004, from <http://www.aseanfocus.com/asiananalysis/article.cfm?articleID=547>

- Kamwendo, G. H. (2005). Language planning from below: An example from Northern Malawi. *Language Policy*, 4(2), 143-165.
- Kim, S. H. (2001). *Language alternation behaviour among native-speaking foreign language teachers in New Zealand secondary schools*. Unpublished MA thesis, The University of Auckland, New Zealand.
- Kim, S. H., & Elder, C. (2005). Language choices and pedagogic functions in the foreign language classroom: A cross-linguistic functional analysis of teacher talk. *Language Teaching Research*, 9(4), 355-380.
- Kong, S. H. (2008, 3 September). "Science and maths in English" assessment. *The Sun*, p. 11.
- Konting, M. M. (1993). *In search of good practice: Learning from the effective teachers in Malaysia*. Paper presented at the Annual Meeting of the British Educational Research Association, Liverpool, England, 10-13 September.
- Krashen, S. (1981). *Second language acquisition and second language learning*. Oxford: Pergamon Press.
- Kyeyune, R. (2003). Challenges of using English as a medium of instruction in multilingual contexts: A view from Ugandan classrooms. *Language, Culture and Curriculum*, 16(2), 173-184.
- Laplante, B. (1997). Teaching science to language minority students in elementary classrooms. *NYSABE Journal*, 12, 62-83.
- Lawson, H., & Briar-Lawson, K. (1997). *Connecting the dots: Progress toward the integration of school reform, school-linked services, parent involvement and community schools*. Oxford, Ohio: School of Education, Miami University.
- Le Cornu, R., & Collins, J. (2004). Re-emphasizing the role of affect in learning and teaching. *Pastoral Care in Education*, 22(4), 27-33.
- Lee, L. (2000). Evaluating intermediate Spanish students' speaking skills through a taped test: A pilot study. *Hispania*, 83(1), 127-138.
- Lee, M. N. N. (2006). Centralized decentralization in Malaysian education. In C. Bjork (Ed.), *Educational decentralization: Asian experiences and conceptual contributions* (pp. 149-158). Dordrecht: Springer.
- Lehtse, A. (2012). *Learning CLIL through CLIL: Teacher students' perceptions of the practice and its effectiveness*. Unpublished Master's dissertation, Tartu University. Tartu.
- Leinhardt, G. (1986). Expertise in mathematics teaching. *Educational Leadership*, 43(7), 28-34.

Lemke, J. L. (1998). *Teaching all the languages of science: Words, symbols, images, and actions*. Paper presented at the Conference on Science Education. Retrieved 3 March 2010, from <http://academic.brooklyn.cuny.edu/education/jlemke/sci-ed.htm>

Let's be more realistic, not ideological. (2009, 12 July). *Sunday Star*, p. F25.

Lewis, C., Perry, R., & Murata, A. (2006). How should research contribute to instructional improvement? The case study lesson. *Educational Researcher*, 35(3), 3-14.

Lidbury, B., & Zhang, F. (2008). Comprehension of scientific language as a strategy to enhance learning and engagement for molecular biology students. *Australian Biochemist*, 39(3), 10-13.

Lightbown, P. M., & Spada, N. (1995). Focus-on-form and corrective feedback in communicative language teaching: Effects on second language learning. In H. B. Douglas & S. Gonzo (Eds.), *Readings on second language acquisition*. Englewood Cliffs, N.J.: Prentice Hall Regents.

Lim, B. S. & Teoh, B. S. (2007). Malay lexicalized items in Penang Peranakan Hokkien. In M. Alves, P. Sidwell & D. Gil (Eds), *SEALVIII: Papers from the 8th meeting of the Southeast Asian Linguistics Society* (pp. 149-165). Canberra, Pacific Linguistics

Liong, K. C. (2010, 31 May). Teachers need help to improve their English. *The Star*, p. N46.

Liong, K. C. (2011, 21 February). A teacher's earnest plea. *The Star*, p. N44.

Little, J. W., & Bartlett, L. (2002). Career and commitment in the context of comprehensive school reform. *Teachers and Teaching: Theory and Practice*, 8(3-4), 345-354.

Loga, M. B. (2005). *A Malaysian English primer*. Kuala Lumpur, University of Malaya Press.

Long, M. H., & Robinson, P. (1998). Focus on form. In C. Doughty & J. Williams (Eds.), *Focus on form in classroom second language acquisition*. Cambridge: Cambridge University Press.

Lorenzo, F., Casal, S., & Moore, P. (2009). *The effects of content and language integrated learning in European education: Key findings from the Andalusian Bilingual Sections Evaluation Project*. Oxford: Oxford University Press.

Loughran, J. J. (2007). Teachers as leaders: Building a knowledge base of practice through researching practice. In T. Townsend & R. Bates (Eds.), *Handbook of teacher education*. Dordrecht: Springer.

Lundsteen, S. W. (1976). *Children learn to communicate*. Englewood Cliffs, New Jersey: Prentice-Hall.

- Ma, L. (1999). *Knowing and teaching elementary mathematics*. Mahwah, New Jersey: Lawrence Earlbaum Associates Publishers.
- Macaro, E. (1997). *Target language, collaborative learning and autonomy*. Clevedon, UK: Multilingual Matters.
- Macaro, E. (2001). Analysing student teachers' codeswitching in foreign language classrooms: theories and decision making. *The Modern Language Journal*, 85(4), 531-548.
- MacDonald, A. (2004). Collegiate or compliant? Primary teachers in post-McCrone Scotland. *British Educational Research Journal*, 30(3), 413-434.
- MacKinnon, I. (2008, 18 January). Immersion is a difficult lesson. *Guardian Weekly*. Retrieved 4 May 2009, from <http://www.guardian.co.uk/education/2008/jan/18/tefl.ianmackinnon>
- Major, C. H., & Palmer, B. (2006). Reshaping teaching and learning: The transformation of faculty pedagogical content knowledge. *Higher Education*, 51, 619-647.
- Mallika Vasugi (2012, 19 February). Let teachers teach. *Sunday Star*, p.9.
- Maria, Z. (2008, 24-27 November). The education system's policies and pitfalls. *Harakah*, p. N21.
- Marsh, D. (2008, 8 April). Adding language without taking away. *Guardian weekly*. Retrieved 9 August 2010, from <http://www.guardian.co.uk/guardianweekly/story/0,12674,1464367,00.html>
- Martin, J. R. (1990). Literacy in science: Learning to handle text as technology. In F. Christe (Ed.), *Literacy for a changing world* (pp. 79-117). Victoria, Australia: Australian Council for educational Research.
- Martin, P. W. (1999). Close encounters of a bilingual kind: interactional practices in the primary classroom in Brunei. *International Journal of Educational Development*, 19(2), 127-140.
- Mays, N., & Pope, C. (1995). Rigour in qualitative research. *British Medical Journal*, 311, 109-112.
- McNaughton, S. (2002). *Meeting of minds*. Wellington, New Zealand: Learning Media Limited.
- Medina-Jerez, W., Clark, D. B., Medina, A., & Ramirez- Marin, F. (2007). Science for ELLs: Rethinking our approach. *The Science Teacher*, 74(3), 52-56.
- Mehan, H. (1985). The structure of classroom discourse. In T. A. V. Dijk (Ed.), *Handbook of discourse analysis: Discourse and dialogue* (Vol. 3, pp. 119-131). London: Academic Press.

- Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Avon: Multilingual Matters Ltd.
- Met, M. (1995). Teaching content through a second language. In F. Genesee (Ed.), *Educating second language children* (pp. 159-182). Cambridge: Cambridge University Press.
- Meyer, L. M. (2000). Barriers to meaningful instruction for English learners. *Theory into practice*, 39(4), 228-237.
- Ministry of Education, (2001) *Educational milestones in Malaysia*. Kuala Lumpur: Ministry of Education, Malaysia.
- Ministry of Education, (2002). *Curriculum Specifications, Science Year 1-5*. Kuala Lumpur: Curriculum Development Centre, Ministry of Education.
- Ministry of Education, (2004) *The Development of Education: National report of Malaysia*. Kuala Lumpur: Ministry of Education, Malaysia.
- Mohamad Fadhili, Y., Mohd Asri, M. N., Ahmad Azman, M., Rafizah, M. R., Mahmud, O., & Kamaruzaman, J. (2009). Teaching of mathematics and science in English: The teachers' voices. *English Language Teaching*, 2(2), 141-146.
- Mohan, B. (1979). Relating language teaching and content teaching. *TESOL Quarterly*, 13(2), 171-182.
- Mohan, B. (1986). *Language and content*. Reading, MA: Addison-Wesley.
- Mohd Hamzah, J. (2004, 9 Febuary). University status for teaching colleges. *New Straits Times*, p. 8.
- Morgan, C., & Morris, G. (1999). *Good teaching and learning: Pupils and teachers speak*. Buckingham, Philadelphia: Open University.
- Morgan, N., & Saxton, J. (2006). *Asking better questions* (2nd ed.). Markham, Ontario: Pembroke Publishers.
- Mort, P. (1964). Studies in educational innovation from the Institute of Administrative Research: An overview. In M. B. Miles (Ed.), *Innovation in education* (p. 317-328). New York: Teachers College Press, Columbia University.
- Mueller, A. (1997). Discourse of scientific inquiry in the elementary classroom. *Journal of the Elementary Science Education*, 9(1), 15-33.
- Murphey, T. (1997). Content-based instruction in an EFL setting: Issues and strategies. In M. A. Snow & D. M. Brinton (Eds.), *The content-based classroom: Perspectives on integrating language and content*. White Plains, NY: Longman.
- Myhill, D., & Warren, P. (2005). Scaffolds or straitjackets? - Critical moments in classroom discourse. *Educational Review*, 57(1), 55-69.

- Nassaji, H. (2000). Towards integrating form-focused instruction and communicative interaction in the second language classroom: Some pedagogical possibilities. *The Modern Language Journal*, 84(2), 241-250.
- Nathesan, S. (2010, 9 August). Do we have the right teachers as educators? *The Star*, p. 44.
- Nell, N. & Müller, H. (2010). The impact of teachers' limited English proficiency on English second language learners in South African schools. *South African Journal of Education*, 30, 635-650.
- Netto, A. (2002). Clash over English in Malaysia's schools. Retrieved 25 August 2004, from http://www.atimes.com/atimes/Southeast_Asia/DJ29Ae04.html
- Ng, Y. M. (2005). *Improving teaching and learning skills through the interplay between action research and video taping in the teaching and learning of science and mathematics in English: a case study*. Paper presented at Seminar Penyelidikan Kebangsaan, Kuala Lumpur.
- Nias, J. (1996). Thinking about feeling: The emotions in teaching. *Cambridge Journal of Education*, 26(3), 293-306.
- Nicholas, H., Lightbown, P. M., & Spada, N. (2001). Recasts as feedback to language learners. *Language Learning*, 51(4), 719-758.
- Nik Safiah, K. (2009, 12-15 January). PPSMI dasar tidak adil, mesti ditamatkan! *Harakah*, p. N10.
- Noraini, I., Gill, S. K., Nambiar, R. M. K., & Tan, K. H. (2009). CLIL for science lectures: Raising awareness and optimizing input in a Malaysian university. *European Journal of Social Sciences*, 10(1), 93-101.
- Noraini, I., Loh, S. C., Norjoharuddeen, M. N., Ahmad Zabidi, A. R., & Rahimi, M. S. (2007). The professional preparation of Malaysian teachers in the implementation of teaching and learning of mathematics and science in English. *Eurasia Journal of Mathematics, Science & Technology Education*, 3(2), 101-110.
- Ong, S. L. (2004). Preparing pre-service teachers to teach science in English. 4(1), 23-31.
- Ong, S. L., & Tan, M. (2008). Mathematics and science in English: Teachers' experience inside the classroom. *Jurnal Pendidik dan Pendidikan*, 23, 141-150.
- Orlich, D. C., May, F. B., & Harder, R. J. (1973). Change agents and instructional innovation: Report 2. *The Elementary School Journal*, 73(7), 390-398.
- Osborn, M. (1996). The highs and lows of teaching: 60 years of research revisited. *Cambridge Journal of Education*, 26(3), 455-461.

- Paksa rela punca guru PPSMI lemah bahasa Inggeris. (2008, 3 September). *Utusan Malaysia* Retrieved 3 March 2009, from http://www.utusan.com.my/utusan/info.asp?y=2008&dt=0904&pub=Utusan_Malaysia&sec=Pendidikan&pg=pe_01.htm
- Palaniapan, P. T. A. (2007). *Pelaksanaan dasar penggunaan bahasa Inggeris dalam pengajaran sains dan matematik di beberapa buah sekolah menengah di daerah Ulu Selangor*. Unpublished M.Ed. thesis, Universiti Malaya, Kuala Lumpur. Universiti Malaya, Kuala Lumpur.
- Pate, R. T., & Bremer, N. H. (1967). Guiding learning through skilful questioning. *The Elementary School Journal*, (May), 417-422.
- Peers, C. E., Diezmann, C. M., & Watters, J. J. (2003). Supports and concerns for teacher professional growth during the implementation of a science curriculum innovation. *Research in Science Education*, 33, 89-110.
- Peng, A. (2007). Knowledge growth of mathematics teachers during professional activity based on the task of lesson explaining. *Journal of Mathematics Teacher Education*, 10(4-6), p. 289-299.
- Perozzi, J. A., & Chavez-Sanchez, M. L. (1992). The effect of instruction in L1 on receptive acquisition of L2 for bilingual children with language delay. *Language, Speech and Hearing Services in the Schools*, 23, 348-352.
- Peterson, P. W. (1997). Knowledge, skills, and attitudes in teacher preparation for content-based instruction. In M. A. Snow & D. M. Brinton (Eds.), *The content-based classroom: perspectives on integrating language and content*. White Plains, NY: Longman.
- Pica, T. (2002). Subject-matter content: How does it assist the interactional and linguistic needs of classroom language learners. *Modern Language Journal*, 86(1), 1-19.
- Pillai, M. G. G. (2002a). English: What you see is what is not. Retrieved 31 August 2004, from <http://tranung4.tripod.com/b08/pillai272.htm>
- Pillai, M. G. G. (2002b). English as she is not spoke. Retrieved 31 August, 2004, from <http://lamankm2.tripod.com/cgi-bin/m/KM2/7314.html>
- Pillay, H. (1998). Issues in the teaching of English in Malaysia. Retrieved 26 July 2003, from <http://jalt-publications.org/tlt/files/98/nov/pillay.html>
- Pirie, S. E. B. (1998). Crossing the gulf between thought and symbol: Language as (slippery) stepping-stones. In H. Steinbring, M. G. B. Bussi & A. Sierpiska (Eds.), *Language in use in mathematics classrooms*. Reston, VA: National Council of Teachers of Mathematics.
- Polio, C. G., & Duff, P. A. (1994). Teachers' language use in university foreign language classrooms: A qualitative analysis of English and target language alternation. *The Modern Language Journal*, 78(3), 313-326.

- Pontefract, C., & Hardman, F. (2005). The discourse of classroom interaction in Kenyan primary schools. *Comparative Education*, 41(1), 87-106.
- Pupur, P. (2006). Antara aku, mereka dan peralatan PPSMI. *Jurnal Pendidikan Tindakan*, 1, 111-119.
- Qorro, M. (Producer). (2006). Does language of instruction affect quality of education? Retrieved 23 December 2012, from <http://www.policyforum-tz.org/does-language-instruction-affect-quality-educationmartha-qorro-dar-es-salaam>.
- Quirk, R., Greenbaum, S., Leech, G., & Svartvik, J. (1985). *A comprehensive grammar of the English language*. London: Longman.
- Rahimah, A. (1994). *Educational development in Malaysia: The dilemma of values education*. Paper presented at the 8th International Intervisitation Program (IIEP 94), Toronto, Canada, 15-27 May.
- Ramatlapana, K. A. (2009). Provision of in-service training of mathematics and science teachers in Botswana: Teachers' perspectives. *Journal of Mathematics Teacher Education*, 12(2), 153-159.
- Rasidi, M. S. (2004). *Pelaksanaan dasar penggunaan bahasa Inggeris dalam pengajaran sains dan matematik di sebuah sekolah menengah Kuala Lumpur*. Unpublished M.Ed.Mgmt. thesis, Universiti Malaya, Kuala Lumpur. Universiti Malaya, Kuala Lumpur.
- Revathi, R., Koo, Y. L., & Jamilah, M. (2006). The discourses of doing science in English: Narrating the interactions between policy and practice. *3L Journal of Language Teaching, Linguistics and Literature*, 11, 191-211.
- Riemer, M. J. (2002). English and communication skills for the global engineer. *Global Journal of Engineering Education*, 6(1), 91-100.
- Roth, W. (2004). Telling in purposeful activity and the emergence of scientific language. In R. Yerrick (Ed.), *Establishing scientific classroom discourse communities: multiple voices of teaching and learning research* (pp. 45-71). Mahwah, NJ: Lawrence Erlbaum Associates, Incorporated.
- Saavedra, E. (1996). Teachers study groups: Contexts for transformative learning and action. *Theory into Practice*, 35(4), 271-277.
- Sage, R. (2006). *Supporting language and communication: A guide for school support staff*. London: Paul Chapman.
- Sathasivam, C. (2011, 13 July). Striving for good English. *The Star*, p. 40.
- Savage, L. B. (1998). Eliciting critical thinking skills through questioning. *The Clearing House*, 71(5), 291-293.
- Setati, M., & Adler, J. (2000). Between languages and discourses: Language practices in primary mathematics classrooms in South Africa. *Educational Studies in Mathematics*, 43(3), 243-269.

- Sharpe, T. (2008). How can teacher talk support learning? *Linguistics and Education*, 19, 132-148.
- Sherin, M. G., & van Es, E. A. (2005). Using video to support teachers' ability to notice classroom interactions. *Journal of Technology and Teacher Education*, 13(3), 475-491.
- Shulman, L. S. (1988). A union of insufficiencies: Strategies for teacher assessment in a period of educational reform. *Educational Leadership*, November, 36-41.
- Shulman, L. S. (2004). Those who understand: Knowledge growth in teaching. In *The wisdom of practice: Essays on teaching, learning and learning to teach* (p. 187-215). San Francisco: Jossey-Bass.
- Sinclair, J. M., & Brazil, D. (1982). *Teacher talk*. Oxford: Oxford University Press.
- Smith, T. M., Desimone, L. M., Timothy, L. Z., Dunn, A. C., Bhatt, M., & Rumyantseva, N. L. (2007). Inquiry-oriented instruction in science: Who teaches that way? *Educational Evaluation and Policy Analysis*, 29(3), 169-199.
- Snow, C. E. (2001). Knowing what we know: Children, Teachers, Researchers. *Educational Researcher*, 30(7), 3-9.
- Sophia, M. Y., Marsh, D., Ong, E. T., & Lai, Y. Y. (2009). Learners' perceptions towards the teaching of science through English in Malaysia: A quantitative analysis. *International CLIL Research Journal* 1(2), 54-69.
- Sophia, M. Y., Ong, E. T., Hashimah, A., Sadiyah, B. and Lai, Y. Y. (2010). Teaching science through English: Engaging pupils cognitively. *International CLIL Research Journal*, 1(3), 46-59.
- Southwest Educational Development Laboratory. (2002). Instructional coherence: The changing role of the teacher.
- Stritikus, T. T. (2003). The interrelationship of beliefs, context, and learning: The case of a teacher reacting to language policy. *Journal of Language Identity, and Education*, 2(1), 29-52.
- Swain, M. (1985). Communicative competence: Some roles of comprehensible input and comprehensible output in its development. In S. M. Gass & C. G. Madden (Eds.), *Input in second language acquisition*. Boston, Massachusetts: Heinle & Heinle Publishers.
- Takashi-Breines, H. (2002). The role of teacher talk in a dual language immersion third grade classroom. *Bilingual Research Journal*, 26(2), 461-485.
- Tam, W., & Cheng, Y. (2007). Teacher education and professional development for sustainable school effectiveness. In T. Townsend (Ed.), *International handbook of school effectiveness and improvement* (p. 751-766): Springer.

- Tamsin, M. (2002). *Does speaking improve students' writing in mathematics?* Paper presented at the 2002 Annual Conference of the Australian Association for Research in Education, Brisbane, Australia, 1-5 December.
- Tan, M. (2011). Mathematics and science teachers' beliefs and practices regarding the teaching of language in content learning. *Language Teaching Research*, 15(3), 325-342.
- Tay, S. S. H. (2009). *English and Asia*. Kuala Lumpur: International Islamic University Malaysia.
- Teachers, students adapting well to English switch. (2004). *New Straits Times*, Retrieved 14 January 2004, from http://www.emedia.com.my/Current_News/NST/Thursday/National/20040115080723/Article
- Teaching of maths and science in English: The story on thinking science and speaking English. (2002, 10 May). *New Straits Times*, p. 22.
- Thomas, W. P., & Collier, V. P. (1997-98). Two languages are better than one. *Educational Leadership*, 55(4), 23-26.
- Toll, C. A. (2001- 2002). Can teachers and policy makers learn to talk to one another? *The Reading Teacher*, 55(4), 318-325.
- Townsend, J. S., & Pace, B. G. (2005). The many faces of Gertrude: Opening and closing possibilities in classroom talk. *Journal of Adolescent & Adult Literacy*, 48(7), 594 - 605.
- Treagust, D. F., & Rennie, L. J. (1993). Implementing technology in the school curriculum: A case study involving six secondary schools. *Journal of Technology Education*, 5(1), 38-53.
- Tsui, A. B. M. (1995). *English conversation*. Oxford: Oxford University Press.
- Tsui, A. B. M. (2007). What shapes teachers' professional development? In J. Cummins & C. Davison (Eds.), *International handbook of English language teaching* (Vol. 11, p. 1053-1066). Norwell, MA: Springer.
- Turner-Bisset, R. (2001). *Expert teaching: Knowledge and pedagogy to lead the profession*. London: David Fulton.
- Uys, M., van den Berg, R., & Botha, S. (2007). English medium of instruction: A situation analysis. *South African Journal of Education*, 27(1), 69-82.
- Valdes, G. (2004). Between support and marginalization: The development of academic language in linguistic minority children. *International Journal of Bilingual Education and Bilingualism*, 7(2-3), 102-132.
- van Hover, S. & Pierce, E. (2006). "Next year will be different:" Two first-year history teachers' perceptions of the impact of Virginia's Accountability Reform on their instructional decision-making. *Journal of Social Studies Research*, 30(2), 38-50.

- Vasanthi, R. (2004, 4 January). Time to re-examine our priorities in education. *New Straits Times*, p. F4.
- Veloo, K. (2003). *Reaksi guru terhadap dasar penggunaan bahasa Inggris dalam pengajaran sains dan matematik: Satu tinjauan di Daerah Kinta*. Unpublished M. Ed. thesis, Universiti Malaya, Kuala Lumpur.
- Viiri, J., & Saari, H. (2006). Teacher talk patterns in science lessons: Use in teacher education. *Journal of Science Teacher Education*, 17(4), 347-365.
- Vikstrom, A. (2008). What is intended, what is realized, and what is learned? *Journal of Science Education*, 19, 211-233.
- Vulliamy, G., Kimonen, E., Nevalainen, R., & Webb, R. (1996). Teacher identity and curriculum change: A comparative case-study analysis of small schools in England and Finland. *Comparative Education*, 33(1), 97-115.
- Vygotsky, L. S. (1962). *Thought and language*. Cambridge: Massachusetts Institute of Technology Press.
- Waller, W. (1932). *The sociology of teaching*. New York: Wiley.
- Walsh, S. (2002). Construction or obstruction: Teacher talk and learner involvement in the EFL classroom. *Language Teaching Research*, 6(1), 3-23.
- Warrington, S. D. (2008). Concerns with content-based instruction (CBI) in Asian contexts. *The Buckingham Journal of Language and Linguistics*, 1, 129-141.
- Weiss, I. R. (2004). What is high-quality instruction? *Educational Leadership*, 61(5), 24-28.
- Wellington, J., & Osborne, J. (2001). *Language and literacy in science education*. Buckingham, UK: Open University Press.
- Wells, G. (2008). Learning to use science concepts. *Cultural Studies of Science Education*, 3, 329-350.
- Welner, K. G. (1999). They retard what they cannot repel: Examining the role teachers sometimes play in subverting equity-minded reforms. *Journal of Negro Education*, 68(2), 200-212.
- Wilson, S. M., Shulman, L. S., & Richert, A. E. (1987). "150 different ways" of knowing: Representations of knowledge in teaching. In J. Calderhead (Ed.), *Exploring teachers' thinking* (pp.104-124). London: Cassell Educational Limited.
- Wong-Fillmore, L. (1985). When does teacher talk work as input? In S. M. Gass & C. G. Madden (Eds.), *Input in second language acquisition* (pp. 17-50). Boston, Massachusetts: Heinle & Heinle Publishers.

- Wong-Fillmore, L. (1992). Language and cultural issues in early education. In S. L. Kagan (Ed.), *The care and education of America's young children: Obstacles and opportunities* (90th yearbook of the National Society for the Study of Education). Chicago: National Society for the Study of Education.
- Wong-Fillmore, L., & Snow, C. E. (2000). *What teachers need to know about language*. Washington, DC: Centre for Applied Linguistics.
- Wragg, E. C., & Brown, G. (2001). *Questioning in the primary school*. London: RoutledgeFalmer.
- Yeow, P. W. (2003). *How critical are critical friends? An initial study on the implementation of the buddy support system*. Paper presented at the ELTC ETeMS Conference 2003: Managing Curricular Change, Kuala Lumpur, 2-4 December.
- Yerrick, R. (1998). Reconstructing classroom facts: Transforming lower track science classrooms. *Journal of Science Teacher Education*, 9(4), 241-270.
- Yerrick, R., Ross, D., & Molebash, P. (2005). Too close for comfort: Real-time science teaching reflections via digital video editing. *Journal of Science Teacher Education*, 16, 351-375.
- Yin, R. K. (1994). *Case study research: design and methods* (Vol. 5). Thousand Oaks, California: Sage Publications.
- Yoon, J., & Onchwari, J. A. (2006). Teaching young children science: Three key points. *Early Childhood Education Journal*, 33(6), 419-423.
- Zaidah, Z. (2007). Case study as a research method. *Jurnal Kemanusiaan*, 9, 1-6.
- Zainal Abidin, A. W. (1998). *Bahasa dan pendidikan aliran Melayu dalam pembangunan kebangsaan*. Paper presented at the Simposium Mahasiswa Melayu, Kuala Lumpur, 22 November.
- Zembylas, M., & Barker, H. B. (2007). Teachers' spaces for coping with change in the context of a reform effort. *Journal of Educational Change*, 8, 235-256.

Appendix 1

Appendix 1

Appendix 2: Observation Sheet for Teacher Classroom Talk

Date: _____ Start at: _____ Finish at: _____ Duration: _____

Subject: Math/ Science Topic: _____

Class: _____ Number of students: _____ girls: _____ boys: _____

Student characteristics (command of English/willingness to speak/behaviour):

Name of teacher: _____ Teacher's objectives: _____

Language problems (sentence construction/vocabulary/pronunciation/delivery of message):

How the teacher deals with language problems _____

Researcher's comments/reflections _____

Appendix 3: Teacher Questionnaire

Background

Teacher code: _____

1. School : _____
2. Age : _____
3. Race : _____
4. English grade for SPM : _____
5. Bahasa Malaysia grade for SPM: _____
6. Name of Institution where you received teaching training :

7. Qualification received :

8. Year you qualified as teacher : _____
9. What were courses taught in English in teacher training Institution? Please name course (s)

10. What English proficiency classes did you attend in teacher training Institution? Please specify level.

11. What is your specialist area(s)?

12. In what year did you start teaching mathematics/ science in English?

13. Which of the following training programs did you attend?
 ETeMS PIERS Others: _____
14. Duration of training:

15. Number of hours of training:

16. What were you taught during training? You may tick more than one.
 Methodology Reading skills Speaking skills
 Grammar Writing skills Others: _____

17. Was the training useful? Yes No

18. Please explain why.

Teacher perceptions on English for mathematics and science policy

19. How do you feel about the English for mathematics and science policy?

20. What are the objectives of this policy?

a. _____

b. _____

c. _____

d. _____

21. Do you think these objectives are achievable? Tick one.

Yes No

22. Please explain why.

23. Do you think you have achieved these objectives in your classrooms? Tick one.

Yes No In some ways

24. Please explain in what way you have succeeded or failed.

25. What was your initial reaction to the government's decision that mathematics/science be taught in English?

26. How confident were you about teaching mathematics/science through English when first told to do so?

- very confident confident quite confident
 not confident not confident at all

27. Do you think mathematics/science through English for primary school students is a good idea? Tick one.

- Yes No

28. Why do you think so?

29. Do you think the students were ready for this change?

- Yes No

30. How did the pupils respond to classes in English?

31. To what extent does the policy affect your students' understanding of the subject?

32. Do you believe that students' English proficiency can be improved through mathematics and science taught through English?

- Yes No In some ways

33. How do you feel about teaching mathematics/science through English now?

34. Why do you feel this way?

Teaching mathematics/science through English

35. Do you teach mathematics/science through English in the same way as you did when you taught through Bahasa Malaysia? Tick one.

- Yes No

36. If your answer is yes, please explain how you are able to retain your old approach.

37. If your answer is no, how is your approach different?

38. Do you face any problems teaching mathematics/science through English now?

- Yes No (If no, please go to question 42)

39. Describe briefly the problems you now face teaching mathematics/science through English.

40. What are the factors which contribute to some of the problems you face teaching mathematics/science through English?

41. How do you solve the problems?

42. On the average, how much time do you spend preparing for a mathematics/science lesson?

43. Which aspect(s) of the lesson do you pay the most attention to in your preparation?

44. What do you usually do to prepare for your mathematics/science lessons?

Language related issues

45. How much Bahasa Malaysia do you still use in your teaching? Tick one.

- 10% 30% 50% over 50%

46. When do you use Bahasa Malaysia instead of English in your teaching?

47. How comfortable are you with the level of English in the textbook for the following? Respond to those relevant to you.

Standard 3: _____

Standard 4: _____

Standard 5: _____

48. How do you help pupils understand a lesson when you feel the language used in the textbook is too difficult? You may tick more than one.

- Explain the new concepts in English using simple words and sentences first and then get pupils to read the textbook.
- Translate only difficult words into Bahasa Malaysia.
- Translate everything in English into Bahasa Malaysia.
- Explain the new concepts in Bahasa Malaysia first and then get students to read the textbook.
- Rephrase in simpler sentences and words what's in the textbook but don't use any Bahasa Malaysia.

49. How often do your students use Bahasa Malaysia during mathematics/science lessons? Tick one response.

- Never Rarely Often Sometimes Always

50. For what purpose(s) do your students use Bahasa Malaysia during mathematics/science lessons?

51. Please describe how students cope with the following in their textbook

Standard: _____

	Good student	Average student	Weak student
Instructions			
Metalanguage			
Technical terms			
Questions			

52. In your view, to what extent is the level of English used in the textbooks for the following Standards suited to the level of the pupils? Respond to the Standard relevant to you.

Standard	Good student	Average student	Weak student
3			
4			
5			

Supplementary Materials

53. For what purposes do you use supplementary materials in English in your mathematics/science classroom? You may tick more than one.

- I never use supplementary materials.
- For extra practice.
- For revision.
- For checking pupils' understanding of lesson.
- To keep pupils busy
- Others (please specify): _____

54. Do you give different supplementary materials to the good and the poor pupils?

- Yes No

55. Please explain why.

56. Which of the following supplementary materials do you use? You may tick more than one.

- Workbooks on the market.
- Those sourced from websites on the Internet.
- Those good ones created by teachers in other schools.
- Those in the school's bank.
- Those I create on my own. Others: _____

57. Why do you choose these?

58. Do you write your own materials? _____

- Yes No

59. Please explain why.

Other Teacher Related Issues

60. Which of the following techniques do you use to check pupils' mathematics/ science comprehension? What language do you use?

Strategies to check understanding	English	B.M.
<input type="checkbox"/> I summarize orally the key ideas.	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> I dictate the key ideas.	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> I put the key ideas on the board for pupils to copy into their notebook.	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> I give them a handout with the key ideas.	<input type="checkbox"/>	<input type="checkbox"/>
<input type="checkbox"/> I have a quick quiz.	<input type="checkbox"/>	<input type="checkbox"/>

61. What language do you **generally** use in the mathematics/science classroom for the following? Please explain briefly why.

Tasks	English	B.M.	Reason
Explain tasks			
Give instructions			
Ask questions			
Seek clarification			
Answer questions			
Give feedback			

Appendix 4

Appendix 5: Transcription Convention

The transcription conventions used to transcribe the recorded classroom talk in this study are drawn upon the transcription conventions developed by Jefferson (1979) described below:

<i>Symbol</i>	<i>Function</i>
[Indicates the beginning of overlapping utterances
=	Indicates latching of contiguous utterances
(.)	Short untimed pause
(0.2)	Timed pause in seconds

Adaptations made for this study

<i>Symbol</i>	<i>Function</i>
XXX	Indicates prolonged sound
Students	Two or more speakers in unison
<u>XXX</u>	Indicates teacher speaking turn
{ }	Indicates repetitions and repairs
[XXX]	Indicates phonetic transcription of words uttered
X	Indicates words uttered in Malay
Italics	Indicates translation of utterances spoken in Malay or in English and Malay
()	Indicates contextual events or comments by analyst
...	Indicates an incomplete utterance

Appendix 6: Extracts of Teacher Interview Transcripts in Malay

Extract 4.1T

Kalau macam tajuk yang susah, budak memang minat tajuk tu tapi macam cik gu kan susah nak bagi penerangan. Kadang-kadang susah nak cari term. Apa lambat sangat. Tu yang tercapak bahasa Melayu tu. Kadang-kadang nak recall balik lama sangat. Daripada kita bazir, pikir-pikir, bukak dictionary, baik cakap bahasa Melayu. Camtu lah kalau saya lah.

Extract 4.2T

Dia punya perkataan tu kan saya pergi buat PJJ baru jumpa tu characterisitic (laughs). Kalau SPM tak jumpa tu, ha kalau setakat SPM tak jumpa. Tu tak termasuk type of soil lagi tu. Lagi banyak bahasa-bahasa yang tinggi.

Extract 4.3T

Kalau P & P saya banyak campur Melayu dengan Inggeris lah. Tapi kalau dah tak kena mengena tu cakap bahasa Melayu.

Extract 4.4T

Kalau awal-awal tu kita cuba cakap bahasa Inggeris. Tapi tak faham (laughs) mula-mula tu tak terperangkap OK lah bahasa Inggeris. Lepas tu tak faham tak boleh lah. Karang tak dapat budak tu mati.

Extract 4.5T

Dia dah ada tampal kat meja. Tapi yang saya tampal tu bahasa Inggeris dengan bahasa Melayu. Kalau budak cerdik tu memanglah bahasa Inggeris pun dah faham kan? ..Tapi kalau budak yang darjah 4 tu saya ajar bahasa Melayu semua. Baca yang bahasa Melayu saja. Kalau baca hari-harin faham. Dia ingat.

Extract 4.6T

Teaching approach tu tak sama bila ngajar dalam bahasa Inggeris. Kalau dengan BI tu saya kenalkan dengan vocab dulu. Saya bacakan nota. Membaca sama murid sebab sebab kelas yang lemah kan?... Jadi saya kena membaca dengan murid. Membaca dalam BM, nota dia pun dwibahasa. Jadi saya fotostat saya baca sama-sama dengan mereka lah. Saya baca dia orang ikut. Sambil tu saya terangkan dekat mereka kalau ada perkataan yang ni...saya translatekan dalam BI. Contohnya, kalau perkataan apa ya yang Tahun 6 tu? Prevation? Prever...(Asiah: Preservation) preservation haa...preservation tu waet. Macam tulah maksudnya, saya terbalikkan tapi tak dalah saya buat vocab aje.

Extract 4.7T

Kalau saya, bukan bahasa untuk sains ni. Memang sebutan kan language kan? Saya rasa kalau untuk sains bukan mengenai...untuk fakta...apa tadi sebutan kan? bukan berkaitan dengan itu.

Extract 4.8T

Macam tadi kan, saya sebut burung merpati 'pigen' lepas tu ada student tu tegur saya, "Teacher, 'pigen' ke 'pigeon'?" Oh sorry, sorry pigeon aaa thank you. Kiranya saya belajar juga dari murid yang mana boleh kan?...Kalau burung hantu kakak sebut macam mana? (Asiah: Owl) Saya sebut 'ol' (laughs). Owl, owl.

Extract 4.9T

Saya pernah suruh budak explain... Saya bagi proses pengawetan makanan. Saya bagilah seorang ni buat canning, bottling. Dia dapat benda tu tapi nak explain tu dia tak reti. Setakat menjawab soalan ringkas dia orang boleh. Long pictures, long stories tak boleh.

Extract 4.10T

Rasanya saya dah kata dengan kakak saya tak prepare ni kan? Kebanyakan tak prepare. Tulah macam ni.

Extract 4.11T

Kadang-kadang masa kita ada, tapi kita urus bahagian lain pulak. Mungkin macam tadilah, kita nak buat apa, singing song apa benda tadi? Terpaksa pulak masa free kita ke situ pulak. Jadi ikut masa ikut keperluan. Jadi terpaksa sesuaikanlah dengan keperluan semasa. Ada jugak no preparation (laughs).

Extract 5.1T

Saya risaulah. Saya risau...risaulah...risau sebab kelemahan saya itulah dan saya memang tak minat bahasa Inggeris. Tak minat sebenarnya bahasa Inggeris (Laughs). Masa sekolah pun saya rasa tak pernah lulus bahasa Inggeris tapi bila masa SPM tup tup boleh. Itu pun level tujuh (Laughs).

Extract 5.2T

Baik memang baik tapi bergantung pada guru tu lah. Aa macam sayalah umpamanya saya lah kan? Sebab kita tak biasa juga kan? Ya lah dulu kan? Dulu pun belajar sains BM kan maktab pun BI pun basic aje belajar BI tiba-tiba dikeluarkan undang-undang untuk sains dan matematik dalam BI jadi kita terkejutlah. Rasa gementarlah. Dah macam mana nak speaking BI apa semua kan? aa kita pun kurang pendedahan tentang BI, perkataan BI. Tapi itulah rasa bagus, idea bagus tapi bergantung kepada guru lah. Sebab guru yang kurang pendedahan BI ini aa bermasalah dari sebab itu lah.

Extract 5.3T

Bagi saya, penggunaan keseluruhan bahasa Inggeris itu. Lagi satu term-term, terminology itu aaa because saya nak refer buku, kadang-kadang buku kita ada. Bukan semua buku tu ada kan, up to date. Lagi satu aaa kadang-kadang dictionary kita pun tak mencukupi. Abis tu nak pinjam orang. Orang tu kadang-kadang dia pun nak guna, aaa kita kena kongsi.

Extract 5.4T

Mula dulu saya rasa shocked terkejutlah and macam fearlah and not agree. Saya not confident. Saya rasa masalah tu bagi saya lebih banyak belajar. Kalau dulu macam tak ambil kisah bahasa Inggeris kan? My own self ni masih lagi banyak lagi to learn masih lagi banyak kesalahan grammar.

Extract 5.5T

My problem speaking skill, communication. But I use broken Englishlah. Sebab masa mengajar tu kena cakap berterusan. Sungguhpun tau dia tak datang dengan cepat. Kadang-kadang perkataan BI tu tak sampai. (Laughs) Kalau kadang-kadang tu fikir-fikir boleh sampai. Kadang-kadang yang simple word pun tak boleh sampai kan? Itu kadang-kadang bila akak observe tu simple words pun tak sampai. Kalau tak observe tu kadang-kadang ada yang sampai jugak kan?

Extract 5.6T

Dari segi penyampaian saya dalam mengajar...pengajaran saya, saya lebih yakin (dalam BM). Saya lebih yakin nak menjelaskan sesuatu tajuk. Maksudnya saya tak rasa macam eh betul ke aku cakap ni?...betul kee?.. aa.. sebab kita sendiri pun, bahasa inggeris pun tak...tak tau. Tak terlalu ok la kan? aa jadi kita lebih rasa yakin (mengajar dalam bahasa Melayu).. kan.. aa.. macam tu lah.

Extract 5.7T

Kalau bahasa Inggeris tu kita boleh jugak lakukan. Tapi kita kena makan masa la sebab kita kena belajar dulu, maksud kita study dulu aaa step by step. Kalau experiment tu ada buat report, report tu mesti eh kita nak explain. Macam saya la, saya tak pandai bahasa Inggeris saya nak cakap apa eh lepas ni? Kalau bahasa Melayu kan, ok letakkan alatan dua aaa ambil bahan A masuk ke dalam B. So kita kena fikir kalau dalam aa apa kat papan hitam nak tulis apa ya?

Extract 5.8T

Ye lah fikir jugak kalau kita implement ilmu sains, matematik kita cuma tekankan istilah dia tapi kita tak ambil kira grammar, kadang-kadang kita sendiri pun, grammar kita bukan nya kita pandai sangat kan? Tambah-tambah kalau kita public speaking macam ni aje kan. Tapi dalam BI macam mana pulak dia karang terikut-ikut cara kita ke. Kadang bimbang jugak.

Extract 5.9T

Tengok mood kalau mood hari tu Ok mood berkobar-kobar nak BI dan kelas tu kalau pandai ha then guna English lah. Kalau hari tu confident lebih sikitlah kalau tak ni kita ikut topic jugak. Kalau topic dia rendah OKlah. Macam Year 1 Year 2 ha OK. Kalau topic dia Year 4, Year 5 ni tak boleh nanti budak tak faham.

Extract 5.10T

Nama akak tercalon juga, tapi fikirkan ya allah yang aku dengan beranak kecil, dengan mengajar kelas tambahan, dengan kelas PIERS, bila nak duduk di rumah kan. Fikirkan. Akak jumpa dengan guru besar, kata cikgu, kesian la kat saya, saya dengan anak kecil lagi, dengan bela ayah lagi, dengan tahun 6 pun dah terlibat. Kalau sekarang ni pun, kalau kita darjah 6 hanya free tak datang kelas petang kan cuma hari Isnin dan Jumaat je. Kalau tak hari Selasa, Rabu, Khamis, Sabtu pun kita still lagi pergi di sekolah kan. Macamana saya ni anak sulung, nak bela ayah lagi. Kita anak kecil lagi baru 8 bulan, macam tu kata kan. Pastu anak-anak lain pun nak pay attention, yang duduk asrama, suami pun nak dijaga juga kan. Jadi saya

kata tolong la cikgu excuse. Tolong la...tolong la saya cikgu, tolong la, merayu-rayu akak ni, kalau tidak akak ni agaknya duduk kat sekolah je.

Extract 5.11T

Seronok sangat seronok. Untuk diri sendiri dan mewakili murid yang mana lemah lah dari segi bahasa Inggeris. Sebab saya rasa saya nak menyampaikan isi pelajaran tu lebih mudah. Lebih mudah, dan pelbagai aktiviti lah boleh fikirkan dengan mudah untuk aa.. memahami.. menjelaskan lagi konsep dalam tajuk-tajuk sains. Aaa terutamanya dari segi perkataan-perkataan sainskan? Kadang budak konsep pun masih tak tahu tambahkan lagi dengan perkataan-perkataan yang orang kata boleh nak dikatakan pelik lah. Untuk murid sebut kan? Kadang kita pun tersalah juga sebut kan? Haa tu laa memang seronok laa.

Extract 5.12T

Mesti la seronok suka setuju. Sebab saya sekarang sekarang mengajar kat luar bandar. Bukan semua budak kat dalam luar bandar ni mendapat pendedahan bahasa inggeris yang sepenuhnya. Sebab itu saya lebih mudahkan kita mengajar, tak membebankan penjaga, tak membebankan budak-budak semua.

Extract 5.13T

Seharian punya pengalaman separuh faham separuh tak faham. Yang tak faham tu sebab dia lemah bukan dari segi bahasa Inggeris saja bahasa Melayu pun dia lemah kalau kita cakap dalam bahasa Melayu pun dia tak dapat. Dia nak tangkap satu benda tu lambat. Kalau bahasa Inggeris untuk budak-budak yang kelas atas goodlah. But kelas-kelas yang akhir tu mangsalah sebab bahasa Melayu pun dia lemah kita pulak mengajar dalam bahasa Inggeris. Have to kan sebab soalan dalam bahasa Inggeris. I have to teach them in English also.

Extract 5.14T

Setiap budak ni ada aras dia yang tertentu. Sebab itu macam kelas depan, kita boleh gunakan all English tapi yang dua, tiga, empat, lima memang still mix. Mix language sebab dia orang kalau satu bahasa memang...memang dia dapat, dapat. Tapi...tak tak semua dia boleh absorb. Dia budak tu sebenarnya, lagi satu IQ dia orang kan, dia...dia sentiasa rajin nak pikir, nak pikir. Tuu macam kelas yang belakang ni kadang dia malas, tak berminat nak belajar.

Extract 5.15T

Saya ingat yang belum tercapai tu sebab murid tu sendiri dia belum menguasai yang reading skill tu kan in Malay. Yang mana murid yang dah pandai tu kan yang dia kumpulan yang clever dia dah achieve. Macam saya cakap tadi, murid yang tak boleh menguasai bahasa Melayu sudah tentu dia kurang menguasai bahasa Inggeris lah. Tapi kalau dia selalunya murid yang tak boleh menguasai BM tu kalau dia pandai baca OK. Kalau dia pandai baca dia boleh kadang-kadang boleh menguasai BI daripada BM. Sebenarnya yang memberi kefahaman English tu atau pun tidak kalau dia dapat menguasai reading skill and writing skill. Yang tak menguasai selalu yang tak menguasai tu lah reading and writing skill.

Extract 5.16T

Banyak menjejaskan pelajar yang di belakang. Minat pun mempengaruhi. aa kalau BI ni kita cakap, kita soal, kita yang akan jawab. Dia tak akan bercakap. Dia tak nak bercakap. Aaa bila saya ajar dalam BM ni, saya tanya at least dia orang nak juga sebut sebab dia rasa tak malu, aa tak malu nak sebut dan dia tahu nak sebut. Kalau BI dia.. dia mungkin tahu, tapi nak sebut dalam BI tak tahu. Jadi itu yang membuatkan dia...baik tak payah nak cakap; baik diam aja. Jadi kita tanya.. jadi kita tak kan nak tunggu lama-lama tunggu dia jawab kan? Jadi kita sendiri jawab soalan yang kita tanya dalam perkataan Inggeris.

Extract 5.17T

Dia kelas belakang tu aaa dia tak da respon. Dia diam je tengok kita. Bahasa Melayu camna nak jawab, cuba try. Tapi tak seberapa la jawapan diorang, tak kisah la. Hm kalau BI tu selalu dia salin soalan balik. Dia jawab, jawab soalan jawab tapi dia akan salin soalan balik. Kenapa awak salin? Saya tak paham cikgu. Macam tu je lah. Tapi kalau bahasa Melayu dia akan, dia akan cuba jawab.

Extract 5.18T

The simple words dia obey lah kalau yang ni dia diam. Langsung tak jawab. (Laughs) Tahun ni saya dapat banyak kelas yang kira bukan kelas hujung lah. So saya cakap dalam BI. Tapi kalau dulu pun saya dapat kelas hujung saya cakap juga BI. Kadang-kadang dia orang ni kalau macam oral kan, dia boleh. Tapi bila dah masuk writing ni payah. Macam benda yang mudah, walaupun kita cakap Melayu, "ha cuba beri nama haiwan-haiwan," dia still bagi jawapan dalam English. Dia still bagi English yang simple lah. Burung tak da, dia say bird, tiger.

Extract 5.19T

Dulu murid tu tak tau sangatkan sains tu dalam bahasa Inggeris tapi sekarang dia dah dapat certain-certain word macam plant-pokok, human-manusia. Kalau tak ada sains belum tentu dia tau...I not agree orang cakap sains sekolah rendah tak sesuai sebab saya bersama dengan murid tu saya dapat rasakan. Bila saya tengok satu pengalaman tu kan, saya tengok murid saya certain matematik tu pun saya tak boleh menguasai. Macam pecahan tu kan saya tak tau dalam bahasa Inggeris tapi bila saya tanya budak kan, decimal pun dia tau apa. Saya kata decimal tu apa wow saya dah lupakan? Tapi dia tau. Makna for myself kerugian tapi dia orang tu memang bagus bahasa inggeris sekarang. Dulu kita cuma belajar dalam bahasa Inggeris sahaja. Masa dia sekolah rendah bila matematik dia bahasa Inggeris kadang dia lebih pada language kan?

Extract 5.21T

Beri arahan, tanya soalan dua-dua. Sebab kita tak nak budak tak tahu langsung perkataan BI. At least kalau dia tak tahu buat ayat, dia tahu lah word-word perkataan-perkataan kan?

Extract 5.22T

Dalam Sains ni dia tak tekankan grammar. Janji istilah sains tu budak dapat. Dia nak tu aje.

Extract 5.23T

(Prepare) worksheet and think what I want teach. Think and sometimes use ABM (alat bantu mengajar) kan? Ha tengok, lepas tu fikir dia punya point-point, tak da lah nak language. Susahlah tak da masa. Sebab language makan masa kan?

Extract 5.24T

Saya ni nak suruh budak tu dapat ilmu. Sebab kalau kita tak habis ni, budak tu it's a problem...bahasa ilmu tu tak apa rasa saya biar dia cakap (bahasa Melayu).

Extract 5.25T

Tapi hari tu ada pertelagahan sikit. Sebab dalam Sains dia ada term dia. Yang sebenarnya kalau nak ikut dulu, kalau dia yang JU (jurulatih utama) BI dan JU sains ni dia macam...yang JU sains dia nak kita gunakan istilah. Dia tekankan tentang istilah Sains. Tapi macam JU BI ni dia nak kita language kita betul-betul. Grammar... Dia kalau JU sains tu dia nak istilah Sains tu kita guna. At least dia tau istilah tu dalam BM dia tau dalam BI tentang istilah dia macam observation, Science process skill kan?

Extract 5.26T

Tahun 6 memang fully BM. Kalau Tahun 5 pun fully BM. Sebab satu saya punya penguasaan BI memang kurang lah. Lepas tu kita nak capaikan strategi UPSR tu nak naikkan peratus jadi kita nak murid tu faham dan dia boleh jawab soalan. Sebab soalan UPSR pun dwibahasakan? Kita ambil tindakan sendiri ni (laughs).

Extract 5.27T

Kita orang dah macam-macam buat. Macam aaa skema nak menjawab dalam bahasa Inggeris sains ni kita orang dah buat dah. Tampil atas meja semua, diorang memang tak boleh choose mana jawapannya itu. Nak menjawab cuma salin je kan? Salin tapi kena check la jawapan tu, cara nak menjawab.

Extract 5.28T

Manipulative variable not in the textbook. Dia level UPSR. Textbook only isi kandungan aje. That is for UPSR exam only. Dia kalau, kata UPSR tak de dia tak de lah manipulative variable kan. Yang problem ialah nak UPSR. Jadi kadang-kadang kita 1 hour pun kita patutnya ajar topic textbook kan. Topic tu lah dari buku teks kan tapi kita dah kena ajar yang untuk UPSR.

Extract 5.29T

(Laughs) Mostly just for exams. At this level just for UPSR. Apa-apa bila sampai UPSR budak ni mesti habis sini (Laughs hard). Paksa tak cukup pagi petang, tak cukup petang malam. Janji habis syllabus buat ulangkaji harap-harap kau dapat A UPSR (Laughs). Kalau tak dapat A pun yang hujung-hujung ni at least lulus. Ha itu ajelah tak ada...Kalau kita betul-betul nak buat kita kena banyak masa. Ok buat teori dalam kelas. Ok bring them to makmal do experiment blah blah kan? Jadi kita rasa puas kan? Tapi sekarang ni kita mengejar dengan masa dengan syllabus dengan kemahiran yang banyak dengan tajuk-tajuk ulangkaji yang form 4 form 5 lagi jadi kita macam rush tak tentu arah. Kira UPSR tu macam dia mengganggu jugak lah.

Extract 5.30T

Saya dengar lah dengar dari kawan-kawan yang mana sekolah-sekolah yang boleh mencapai target, yang murid dia ramai yang lulus, aa dia orang sendiri mengajar murid tu yang mana kelas-kelas yang ni dalam BM. Sebab saya fikir ETeMS ni memang aaa orang kementerian dia hanya dapat keputusan mengatakan aa Science and math naik meningkat. Tapi dia tau tak murid menjawab dalam BI atau BM? Sebab soalan masih dwibahasa kan?

Extract 5.31T

Kita ada bengkel, bengkel tu kita group sekali lah. Ambil lah siapa yang mahir bahagian tu macam teknik menjawab seksyen B. Kita buat kat makmal komputer lah. Panatia lah yang berfungsi ni. Tapi setiap kali ujian kita kan mesyuarat lah balik. Sebab-sebab budak tak boleh jawab, apa punca dia. Macam kelas ni bahagian B banyak yang tak boleh skor kan? OK mana kelemahan kita kita bincanglah balik.

Extract 5.32T

Kadang-kadang kita tanya berapa orang budak tak dapat A dapat C. Kita selalu bagi maklumat-maklumat macam ni kan? Jadi kita terpaksa cover macam tu lah terpaksa sumbat budak tu jadi kita minta dia faham ni ni ni. Tapi kepuasan mengajar tu kuranglah dari segi kita...mungkin murid pun sama.

Extract 5.33T

Kita sekarang ni kalau weak students ni memang fully BM. Dalam meeting pun guru besar pun setuju. Tapi dia kata pandai-pandai sebab kita pun nak naikkan peratus sekolah kan?

Extract 5.34T

Macam sekarang ni sekolah kita kekurangan guru BI. Jadi kita tak boleh nak salahkan sekolah sebab sekolah menerima yang hantar ni pihak atasan. Dia tahu kalau satu sekolah tu kalau murid dia ada kalau kelas dia macam ada 29 kelas, sepatutnya berapa orang guru BI mesti ada dekat sini tapi benda tu tak dapat di penuhi. Jadi cik gu-cik gu yang agak boleh sedikitlah menguasai BI dia ambil lah untuk membantu sementara. Tapi kadang-kadang sementara pun lama jugak. Makan tahun ha. Dia ni option BM (referring to a colleague) tapi ajar BI sebab tak cukup cik gu...Kadang-kadang tu membebaskan gurulah. Tapi daripada kelas tu ditinggal macam tu karang kita kadang fikir jugak kan budak ni karang tak belajar. Kita boleh jugak bagi 50% tak dpt 100% pun mungkin 50% kan? Tapi dari segi kepuasan mengajar tu kadang-kadang kurang.

Extract 5.35T

Kalau cuti yang macam bulan 5, bulan 8, bulan 3 tu, takda nama cutinya. Kalau ajar tahun 6 datang kelas, buat kelas, malam pun ada. Kadang-kadang kita rasa macam...ialah tension juga la kan? Tapi ialah itu lah cabaran kita. Rezeki kita ke arah situ kan? Nak buat macamana terpaksa la.

Extract 5.36T

Hari Isnin saya full dari pagi sampai tengahari kadang-kadang ada meeting lagi. Tuition ada lagi. Kadang-kadang orang tak datang jadual saya tak da tapi kiranya orang tu ada problem masalah saya kena gantikan dia. Hari Rabu saya terlibat dengan ko-kurikulum. Kadang-kadang kalau tak ada KK kalau tak pegi KK saya overlapping dengan kelas er kelas bimbingan tahun 6. Kelas intensif. Dan setiap cuti penggal tu kita adalah selagi belum periksa selagi itulah kelas tambahan berlangsung. Kadang-kadang tu kalau ada masalah cik gu tu balik kampung jauh kan kita kena take over. Kita duduk kat kawasan sekolah nak tak, kenalah. Tu saya rasa macam penat sangat.

Extract 5.37T

Ha nak tampal sana bahagian ni tak siap. Buat bilik kajian kadang bilik besar, galeri tu galeri ni. Cat sana cat sini mural sana, mural sini. Memanglah untuk kebaikan sekolah kan tapi membebankanlah. Macam petang ni kan kena datang siapkan tu. Satu bila time sukan, latih budak sukan. Balik sekejap datang balik. Pas tu hantar budak sana. Tambah yang handle sukan tu hantar budak sukan lagi. Berkejar balik kelas. Jadi kita macam kacau lah fikiran tu kacau. Masa kita sebenarnya terlalu banyak...Macam orang office saya tengok kan orang kerja office dia cuma tertumpu kerja perkeranian dia je. Dia tak da pegi bawah buat tu buat ini. Buat rock garden buat landscape tak de kan? Kita guru tak macam tu kerja guru sebenarnya. Kadang-kadang buku budak bawa balik rumah, malam-malam right, jadi sebenarnya bukan habis waktu siang. Tambah lagi semua guru mesti involve dalam sukan dan kelab. Setiap guru kena ambil satu kelab, kena ambil satu permainan, guru kelas.

Extract 5.38T

So kita masuk pertandingan macam ni. Mengajar tu dah jadi benda yang ke-2. Apa yang jadi sekarang ialah semua kelas kosong. Mana cikgu, cikgu pergi cat sana, cikgu pergi cat sini, gantung sana gantung

sini. Saya sendiri secara peribadi, saya kata jangan lah masuk pertandingan-pertandingan macam ni. Saya peduli apa sekolah kita tak dapat nama. Yang penting anak murid kita belajar. Itu saya punya opinion. Saya jumpa dia (headmistress), saya kata this is my opinion, saya kata. It's ok kita nak masuk pertandingan. Cikgu ok, kita akan buat kerja lebih. Tapi boleh tak kalau ada perancangan, saya kata. Jangan tahun ni kita nak masuk, tahun ni kita kena buat semua. Dia kata masalahnya cikgu, dia kata ini bukan kehendak saya. Ini Jabatan, Jabatan yang datang sekolah dan suruh kita masuk. Yes...Jabatan tu siapa? Orang juga. Why not kita utarakan kita punya pandangan pada mereka?

Extract 5.39T

Satu lagi guru ni kalau dihaskan tugas dia prepare untuk mengajar dalam kelas, P&P kita tak apa. Tapi kita ni banyak beban tugas lain. Benda tu mengganggu sebenarnya. Kerja-kerja perkeranian banyak. Kalau menyalin nama murid ni kejap kesihatan nak, kejap bahagian pergigian nak, setiap bahagian hal ehwal murid nak. Jadi benda yang sama sampai akhir tahun esok ada aje menulis tu menulis ni. Jadi kita ni kadang-kadang kita masuk kelas pun kita tak boleh nak buat apa. Sebab kadang-kadang ada benda yang dalam kepala kita yang belum siap.

Extract 5.40T

Sebab saya sekarang sekarang mengajar dekat luar bandar. Bukan semua budak kat dalam luar bandar ni mendapat pendedahan bahasa inggeris yang sepenuhnya. Sebab itu saya lebih mudahkan kita mengajar, tak membebankan penjaga, tak membebankan budak-budak semua.

Extract 5.41T

Macam mana dia nak minat? Dirumah tanya mak mak tak tahu. Lepas tu, jadi simpan jadi tak ada motivasi dia. Tapi tu lah saya rasa dari segi kalau murid di bandar saya rasa mungkin objektif boleh dicapailah. Sebab majority murid dia pun mungkin dah biasa dengan tuisyen-tuisyen di luar banyak kan? Jadi dah terbiasa dengan BI. Tapi dikawasan kampung ni boleh berjaya tapi memakan masa lah.

Extract 5.42T

Awal-awal memang susah tapi lama-lama benda tu dah jadi macam biasa. Sebab awal-awal ni mak-mak budak ni bercakap bahasa Melayu dulu jadi dia tak dapat nak training anak dia. Jadi tiba masa dia nanti, dia train anak dia bahasa Inggeris tak jadi masalah. Peringkat awal ni boleh tercapai tapi tak 100% lah. Sebab tak boleh harap cik gu aje kan? Kita nak belajar ni 24 hours secara formal dengan tak formal.

Extract 5.43T

Dan saya baru-baru ni dengar dari radio aaa PPSMI ni dikekalkan dan diminta syarat supaya masih dwibahasa. Maksudnya diberi kelonggaran lah. Jadi pada fikiran saya kalau dah diberi kelonggaran macam ni, saya rasa tak salah kalau kelas-kelas yang mana kita target tak boleh untuk BI kita ajar dalam BM.

Extract 5.44T

JPNS dia tak tentu jugak. Kadang satu bahasa, kadang dua bahasa. Yang Puan R ni yang terbaru dia tak nak tuu dia tak nak mix language. Dia nak satu, satu bahasa je nak mengajar ni. Tapi ikut pekeliling kita dapat memang dwibahasa. Itu ikut pulak pekeliling daripada JPNS tu dia nak keluarkan soalan dwibahasa. Tapi dia tak nak, dia nak satu bahasa je. Sekarang ni budak dia lebih kepada bahasa Melayu. Jadi dia lebih paham bahasa Melayu tapi soalan pulak dwibahasa. Tu yang budak pun lebih kepada bahasa Melayu. Kalau betul-betul nak buat, biar teaching bahasa Inggeris. Biar soalan semua bahasa Inggeris kan, baru telus kan.

Extract 5.45T

Hari tu Hishamuddin kata mula-mula dulu kata everything in English. Semua dalam BI. Tiba-tiba dah tengah-tengah dah...ubah pulak. Kata boleh dwi bahasa jadi macam kita rasa kalau kita semua dalam BI kita kata budak kita rugi. Kalau kita rasa nak buat semua dalam BM, rasa nanti budak kita dah sampai peringkat tinggi tak tau. Jadi macam kita ni serba salah. Kalau nak buat buat betul-betul. Fix kan betul-betul semua mesti rata. Semua dalam BI ha macam tu kita boleh paksa semua dalam BI kan? Ubah-ubah tu macam menyusahkanlah. Kalau betul-betul nak buat dalam BM buat aje dalam BM.

Extract 5.46T

Satu lagi karang kita preparation kita cik gu ni sebenarnya tak dapat nak buat semua. Macam kita masuk kita ajar tajuk ni. Kadang-kadang kita bukan satu kelas hari tu kan. Mungkin hari tu kita masuk darjah 6 darjah 5, darjah 3, darjah 1 kan? Mungkin kita 2 kelas kita mungkin ready. 2 kelas lagi sebab kita sebagai manusia hari-hari benda ni kan. Kita bukan ngajar 1 subjek masalah dia kalau kita masuk satu kelas tu...macam kita Tahun 5 kan OK 5 satu, 5 dua ni kita ajar sains kan kalau kita buat alat pun berbaloilah kalau kita boleh guna ini kan? Ini kita kejap masuk kelas ni, kejap masuk kelas ni jadi tak logic lah kalau

kita sebagai seorang manusia kan? Hari ni untuk esok kita boleh sedia untuk Tahun 3 ni, untuk Tahun 5 ni, untuk Tahun 6 ni. Hari-hari...Kita cita-cita kita sebenarnya banyak. Ok kita belajar tajuk micro-organism, microorganism ni kan kalau kita nak buat prepare pastry benda-benda tu kan itu mustahil kan? Kita nak juga cara yang kita buat CD ok kita tunjuk ini contoh virus, selain daripada dia tengok gambar. Kita nak ubah bagi benda tu menariklah tapi tak berkesempatan. Take masa lama kan? Kadang-kadang semalaman kita terpaksa menghadap tu tak semestinya kita dapat semua malam tu. Tapi kalau kita khususkan ok kita mengajar tahun ni aja jadi kita fokus kat situ aja. Macam saya kalau dia bagi saya Year 3 lah contohnya, belajar tentang external features of plants, external features of animals jadi kepala saya fikir tentang tu aja. Mungkin boleh. Mungkin saya sediakan worksheet ni saya sediakan dia punya yang leaf yang lain. Boleh tapi kalau semua nak sedia yang tu fikir pulak karang English lagi nak sediakan jadi macam...terpaksa separatelah kita punya pilihan sini sana.

Extract 5.47T

Susah nak plan awal-awal lah. Masa practicum bolehlah planning. Tak kerja apa kan? Ha ni bila ni dapat had kerja waktu free kita tu lah nak buat ni buat ni ha. Tak dapatlah nak planning mengajar.

Extract 5.48T

Tapi kalau bagi diri saya sekolah ni kan ada setahun tak masuk tahun lepas memang cik gu-cik gu dia tenang. Mengajar pun preparedlah. Saya sebab saya sendiri prepared. Tapi memang tahun ni saya tak prepare memang saya tak larat nak prepare. Nak ajar hari ni baru hari ni nak buat lesson. Macamna nak prepare?

Extract 5.49T

Waktu kita terhadlah kak untuk persediaan ni terhad. Kalau di rumah kakak fahamkah kan? Kalau di rumah kita dah tentu dengan keluarga. Macam saya suami dia memang tak suka kerja waktu-waktu di sekolah ni dibuat di rumah. Dia memang tak suka. Anak ada tiga, masih kecil lagi. Jadi faktor tu yang menyebabkan masa untuk buat persediaan di rumah memang tak boleh kak, tak boleh. Tu mungkin tak semua orang samalah kan kak? Tapi macam saya ni sebab husband balik pun petang. Kita balik kadang-kadang tengahari tu tak maksudnya kita relax kan? Kita terus sambung kerja di rumah pulak. Memasuh, memasak. Lepas tu nak hantar dia ke sekolah agama lagi. Jadi tak ada masa kak untuk nak tengok ni. Masa persediaan kita pun memang terhad.

Extract 5.50T

Kita tak boleh cakaplah langsung tak da masa. Itu tipulah kan kak? Kita kena pandai curi masa. Pada saya, saya kena pandai curi masa. Kita tak boleh cakap tak da masa, tu bohong tu kan? Pada saya, saya kena pandai curi masa dan gunakan masa yang ada.

Extract 5.51T

Kadang-kadang tu yang boleh guna sepuluh, computer 40. Jadi jadual-jadual penyelenggaraan tu kena dibaiki lah. Benda tu ada tak boleh guna nak buat apa kan? Kadang-kadang budak masuk pun 10 komputer. Budak 40 (Laughs) macam mana nak buat? Kadang-kadang pun nak senang tak bawa masuk aje (Laughs) sepuluh. Karang yang lain tu entah apa-apa. Payahlah penyelenggaraan tu penting lah. Benda tu dah ada sekarang ni sebenarnya tapi bahagian penyelenggaraan tu kena ada jadual lah. Komputer tu rosak setahun 2 tahun. (Joni pointed out that there were only 4 or 5). Empat lima dah? Ya lah benda tu software, diguna ramai jadi penyelenggaraan tu kena tinggi. Cuba sebulan sekali datang check mana rosak yang tak rosak kan. Tiap-tiap bulan datang...barang penyelenggaraan tu benda tu dah ada di setiap sekolah. Mungkin daerah ni ada satu centre dia kan bahagian penyelenggaraan.

Extract 5.52T

Dekat sekolah kita ni dalam kelas tak cukup computer. Tak cukup, tu susah. Jadi kalau saya, saya bawa dia ke makmal komputer...seminggu sekali paling kurang mesti bawa. Tengok dia punya courseware tu kan? Dapat buat sikit-sikit kerana kekurangan dia punya peralatan.

Extract 5.53T

Lagi satu teknikal problem pun iya juga. Macam makmal komputer, last year saya selalu juga bawa budak masuk makmal komputer tapi this year sekejap blackout. Sekejap aircond masalah. Pasang aircond komputer habis. Technical problem pun satu hal juga. Selalu benda-benda macam ni. Tapi kalau cikgu tu nak masuk makmal komputer boleh tak ada masalah. Maksudnya sekadar untuk penghayatan diaorang kan daripada asyik buat exercise je, same routine everyday. Sese kali kita bawa dia kat makmal komputer memang diaorang akan suka, daripada routine yang biasa tu.

Extract 5.54T

Dia ni masalahnya dia pasang benda tu kat situ, skrin pasang tempat lain. Tu pengurusan punya apa lah. Dia LCD ada situ kan, tergantung tapi skrin tak ada. Sometime skrin tu dibawa entah mana-mana la. Benda ni tak ada skrin ambil daripada kelas tu, ambil daripada kelas tu. Pengurusan lah punya kerja. Actually, memang tak pernah guna.

Extract 5.55T

Tapi ada kelas yang tak boleh ubuh. Macam kelas tu. Ha yang macam ni tak siap, tapi ada kelas yang sebelah tu test tak boleh guna.

Extract 5.56T

Kekurangan bahan bantu mengajar masalah. Budak-budak kelas akhir ni dia kena banyak bahan bantu mengajar. Bahan makmal sepatutnya lengkap kalau sekolah rendah ni. Kita tak da pembantu makmal kan? It's better ada pembantu makmal sebab cik gu sekolah rendah ni kerja dia banyak. Dia bukan mengajar aje. Macam sekolah saya, masuk ni, masuk ni (referring to the competitions). Macamana nak menyediakan bahan bantu mengajar? Sedangkan cik gu tu pun tak da...petang dah sibuk mensyuarat, sibuk gotong royong. Mana nak sediakan bahan bantu mengajar?

Extract 5.57T

Material pun rasa macam tak cukuplah rasanya materials dia. Macam makmal sains pun kita tak complete kadang-kadang kita masuk pun benda yang kita nak cari tak ada (Laughs). Jadi boring lah macam tu kan. Sebab sekolah rendah ni dia bilik sains dia tak complete macam sekolah menengah. Jadi sekarang ni dia dah patut complete. Dia kena buat macam taraf sekolah menengah. Sebab kita punya silibus tu tinggi. Jadi macam tak cukup benda tu kalau kita masuk kadang kalau kita nak buat group pun kan. Satu lagi bilik sains tu macam dah tak sesuai lagilah dia kena makmal sains. Kadang-kadang kita nak sediakan ini...karang masa bila kita nak prepare. Sebelum ni kita ada kelas ni ni. Masa bila? Tak kan kita nak prepare ni untuk besok kalau benda kan? Mungkin cik gu lain masuk selepas tu kan?

Extract 5.58T

Satu lagi sekolah rendah ni, masalah dia satu bila kita buat eksperimen ke apa kan, kawalan dia. Dia tak macam sekolah menengah. Kita pun pernah merasai duduk sekolah menengahkan. Sekolah menengah kita pandai jaga diri kan kita tahu benda ni bahaya ke. Tapi sebab tu kadang-kadang, makmal ni perlu ada pembantu sebab budak ni kadang-kadang bila dia macam excited sangat tak tahu benda tu boleh membahayakan dia ke, kan makmal tau sajalah kan. Jadi kita pun kadang-kadang dari segi tu pun kadang-kadang kita takut jugak. Mungkin benda tajam. Kadang-kadang benda kecil-kecil pun dia kawan cucuk cucuk ha. Kita kadang-kadang fikir benda tu tau. Fikir keselamatan dia sebab everything di tangan kita masa tu kan jadi nak jaga budak tu sekian. Kadang-kadang ya kita bagi arahan, ok buat macam ni tapi budak kan. mungkin ada yang boleh dengar tapi mungkin ada seorang dua orang yg lain tindakan dia tu ha. Kalau makmal kena ada pembantu yang boleh sama-sama turun tengok budak.

Extract 5.59T

Sains patut diajar menghafal hafal- menghafal rumus konsep kena hafal jugak la, macam seolah macam menghafal sifir. Lepas tu perlu ada jugak bacaan dan rujukan. Satu lagi dari segi nota lebih pada berbentuk peta minda. Tak perlu nota yang panjang panjang kan, kasikan word word penting sahaja aaa word penting. Saya kena banyakkkan beri latihan, berbentuk seperti soalan peperiksaan. Nota berbentuk peta minda, dan menghafal. Pembelajaran secara berulang lah berulang maksudnya buat latihan. Salah, correction dia pun berulang. Maksud saya buat, mungkin dengan cara macam tu.. insyaallah bertulis, berulang laa.. dia ingat la kan.

Extract 5.60T

Hands-on banyaklah acitivity hands-on bukan lah lecture aje kan bersyarah. Banyakkkan aktiviti yang babitkan penglibatan muridlah. Amali kerja2 amali. Budak kena buat aktiviti lepas tu kalau ada computer courseware tu lagi bagus ada grafik-grafik. Manafaat dari software tu dia punya visual, warna apa semua. Gambaran tu buat lebih minat pada murid.

Extract 5.61T

Pada saya, sepatutnya sains tu diajar, kalau ikut konsep-konsep yang dulu-dulu, dia memang melibatkan banyak experiment. Maksudnya budak kena buat laa dalam kumpulan supaya cikgu ni sebagai pembimbing. Kalau kita nak teori je memang budak tu memang memang tak dapat, dia tak nampak kan. Dari situ la kita boleh apa, tarik minat murid tarik minat murid. Pastu dia pun cuba aaa kalau dia cuba baru dia nampak. Tapi kalau dulu, kalau kita gunakan bahasa Melayu, itu memang banyak sangat aktiviti yang kita boleh bagi tahu lah, senang.

Extract 5.63T

Kalau dalam BM ni kan dia panjang dua ayat baru dapat dia punya maksud. Cara menjawab soalan bahagian B kan, dia kena panjang kalau dia jawab dalam English pendek tapi meaning dia padat.

Extract 5.64T

Sains masalah. Sebab masalahnya dari segi nak jaga bahasa, nak jaga kemahirannya satu lagi dia punya ilmu.

Extract 5.65T

Kalau BM nak kena create ayat dia kan, tapi kalau English walaupun 2 perkataan tapi dah full marks. Tapi bagi budak yang tak boleh kuasai bahasa, sekarang ni dia bergantung kepada kuasai BI, bagi murid yang tak dapat nak kuasai BI jadi masalah dia nak memahami, nak memahami.

Extract 5.66T

Jadi saya fotostat saya baca sama-sama dengan mereka lah. Saya baca diaorang ikut. Sambil tu saya terangkan dekat mereka kalau ada perkataan yang ni...saya translatekan dalam BM.

Extract 5.67T

Belajar sendiri. Agak-agak sebut aje kak (laughs). Orang malas macam nil ah. Memang saya tak da belajar dengan siapa-siapa. Daripada akaklah akak sebut-sebut tu lah saya ooh...Saya pun tak da rujukan kawan-kawan ke tak da. Saya ada juga tanya tapi benda-benda macam ni kadang-kadang ya lah saya dengar diaorang sebut pun lain. Saya sebut lain. Saya tak da lah tanya orang ajarnya tak da. Sebut sendiri.

Extract 5.68T

Idea dia sama macam saya lah... Maksudnya kalau saya tanya dia pun dia hadapi masalah yang sama. Tu dia nak bagi idea pun kadang-kadang sama-sama (laughs). Cubalah kan?

Extract 5.69T

Maksudnya saya bagi murid choice lah. Kalau dia rasa dia boleh buat bahasa Inggeris, buat bahasa Inggeris. Kalau dia boleh, dia tak yakin untuk BI tu saya akan syorkan dia buat BM. Sebab saya nak tanam minat dia untuk dia lebih mudah faham. Kalau BI kan, dia...kita pun tension kan. Kita mengajar dia melopong, memang dia takkan tahu haa.

Extract 5.70T

Encourage them to speak English. Minta dia cakap BI masa PNP, lepas tu puji lah.

Extract 5.71T

Tapi bila sampai bentuk ayat, dia tak boleh. Kalau single word tu dia masih boleh. Macam haiwanlah kan kita tanya dia, what happen aa pada apa for the for this animal seterusnya mungkin Inggeris dia nak extinct kan? Satu perkataan. Tapi kalau dia nak bentuk ayat tu tak boleh. Dia tahu terminology. Dia faham maksud tu dia tak tahu bahasa.

Extract 5.72T

Kalau first time tu kita sometimes kita tak prepare kan bahan bantu mengajar (BBM) tu just explain. Kalau tak dapat second time tu kita kena prepare the BBM. Sebab kita ni tak cukup masa kan? Kalau ada masa memang bahan bantu mengajarlah tapi dalam keadaan kita yang sibuk ni haa. Most lah. Bahan bantu mengajar memang tak ada sekolah ni. Tu kalau akak masuk pun mana ada sangat kan? Jadi kita kena preparation macam tu lah tengok barang. Cik gu tak da masa nak buat.

Extract 5.73T

Yes berguna dari segi kita nak bercakap dengan murid. Dari segi PNP kita macam biasa. At least dapat belajar cara macam mana nak explain dengan budak dalam B. Inggeris. Perkataan-perkataan baru dalam BI macam tu lah.

Extract 5.74T

Dia ambil di kalangan guru yang, guru bahasa Inggeris. Dia ajar, JU kitalah. Tapi dia pun kadang-kadang pun dia tak mahir. Sebab dia mahir dalam bahasa Inggeris, tapi dia tak mahir dalam penggunaan di dalam sains, penggunaan istilah di dalam matematik.

Extract 5.75T

Tapi masalahnya masa saya pergi tahun dua. Dia suruh mengajar untuk sukatan tahun dua. Masa tu kita tak ada sukatan untuk tahun dua, kita pakai sukatan tahun satu. Yang kita bolehkan. Kita tak guna sukatan tahun dua lah...memang tak ada kan.

Extract 5.76T

To solve problem I still learn lah. I exercise but now no exercise. But I bought book SPM kan? English SPM, MUET. Still do the exercise. But now I have no time (Laughs). Masa habis kat sekolah, anak kecil dua orang, and then I further my study, and then co-curriculum. One week can go home two times after school and holiday, weekend I go to my class at UM. And then school competition, bring the kids.

Extract 5.77T

Saya kalau saya dapat kursus yang berterusan saya tak terasa beban cuma saya dapat kursus sekali. Itu yang saya menjadi beban. Kursus tu tak macam berterusan, sekejap, lepas tu dia macam rush. Aaa jadi saya tak berapa bersetuju lah. Tak lengkaplah, persiapan untuk kita mengajar.

Extract 5.78T

Itu sekarang ni fikir macam mana nak mantapkan BI. Saya pun sebagai yang tak ada kuasa apa-apa ni kadang-kadang kita sendiri terfikir, macam mana nak bagi mantapkan BI. Baik cik gu ke baik murid ke... macam cik gu perlu jugak bahasa yang senang untuk dia faham. Kita nak explanation tu, kita guna bahasa yang senang-senang. Kadang-kadang kita pun tak tahu, apa bahasa yang mudah dia faham. Mmm kadang-kadang kita cakap belit-belit dia pun lagi tak faham kan?

Appendix 7: Pedagogic functions and language codes in three lessons by Ruhani

	L1	L1c	L2	L2c	Mix	Total	%
check	9	1	6	0	1	17	2.0
clarify	7	0	1	0	0	8	1.0
count	0	0	1	0	0	1	0.1
cue	0	1	1	0	1	3	0.4
directive	61	13	41	10	6	131	15.6
echo	1	0	12	0	0	13	1.6
d-que	10	10	43	2	3	68	8.1
g-que	25	6	4	1	4	40	4.8
req BM	0	0	4	1	0	5	0.6
req Eng	0	0	0	0	0	0	0
trunc	8	3	26	2	1	40	4.8
empathy	1	1	0	0	0	2	0.2
evaluate	16	0	75	0	3	94	11.2
expressives	39	3	1	0	1	44	5.3
inform	25	11	27	4	2	69	8.2
label	0	0	10	2	2	14	1.7
metastatement	3	0	5	1	1	10	1.2
miscellaneous	1	2	2	0	1	6	0.7
model-drill	64	0	4	0	0	68	8.1
nominate	0	0	7	0	1	8	1.0
pointer	0	0	36	0	1	37	4.4
prompt	3	0	0	0	0	3	0.4
recast	23	15	32	1	7	78	9.3
restatement	23	4	13	1	1	42	5.0
reply	17	3	5	0	1	26	3.1
review	0	0	3	0	0	3	0.4
starter	1	2	3	1	1	8	1.0
Total	337	75	362	26	38	838	100
%	40.2	8.9	43.2	3.1	4.5	100	

Note: d-que= display question, g-que= genuine question, req BM=request for Malay, req Eng= request for English, text trans= text translation.

Appendix 8: Pedagogic functions and language codes in three lessons by Farina

	L1	L1c	L2	L2c	Mix	Total	%
check	8	2	24	0	0	34	2.7
clarify	2	0	2	0	0	4	0.3
cue	1	0	1	0	0	2	0.2
directive	112	39	125	6	10	292	23.3
echo	1	0	14	0	1	16	1.3
d-que	38	8	39	1	5	91	7.3
g-que	9	2	3	0	0	14	1.1
req BM	0	0	16	0	0	16	1.3
req Eng	2	2	0	0	0	4	0.3
truncation	10	0	7	0	3	20	1.6
empathy	6	4	0	1	0	11	0.9
evaluate	14	0	48	0	3	65	5.2
expressives	56	12	4	2	1	75	6.0
inform	60	28	27	7	16	138	11.0
label	0	0	6	0	0	6	0.5
marker	4	0	12	0	0	16	1.3
metastatement	7	15	16	0	3	41	3.3
miscellaneous	8	6	1	0	0	15	1.2
nominate	2	0	9	0	0	11	0.9
pointer	1	0	34	0	0	35	2.8
prompt	6	0	4	0	0	10	0.8
recast	68	25	49	4	12	158	12.6
restatement	63	8	52	3	5	131	10.4
text trans	4	2	0	0	0	6	0.5
reply	7	3	5	0	1	16	1.3
starter	16	8	3	0	0	27	2.2
Total	505	164	501	24	60	1254	100
%	40.3	13.1	40.0	1.9	4.8	100	

Note: d-que= display question, g-que= genuine question, req BM=request for Malay, req Eng= request for English, text trans= text translation.

Appendix 9: Pedagogic functions and language codes in three lessons by Zuleyka

	L1	L1c	L2	L2c	Mix	Total	%
check	4	1	10	0	0	15	1.1
clarify	7	0	4	0	0	11	0.8
count	0	0	1	0	0	1	0.1
cue	8	2	6	0	0	16	1.2
directive	72	16	112	10	17	227	16.5
echo	4	0	7	0	0	11	0.8
d-que	39	12	79	5	4	139	10.1
g-que	6	3	7	0	0	16	1.2
req BM	0	25	5	0	8	38	2.8
req Eng	2	2	0	0	4	8	0.6
trunc	22	5	40	0	2	69	5.0
empathy	0	0	9	0	0	9	0.7
evaluate	18	3	76	1	0	98	7.1
expressives	23	8	3	0	0	34	2.5
inform	26	24	67	10	10	137	10.0
marker	0	0	1	0	0	1	0.1
metastatement	2	3	7	0	0	12	0.9
miscellaneous	2	4	2	0	0	8	0.6
model-drill	0	0	95	0	0	95	6.9
nominate	0	0	12	0	0	12	0.9
pointer	1	0	56	0	0	57	4.2
prompt	20	0	11	0	0	31	2.3
recast	56	24	104	12	31	227	16.5
restatement	19	6	20	2	2	49	3.6
text trans	17	7	0	0	4	28	2.0
reply	2	0	1	0	0	3	0.2
starter	13	6	0	0	1	20	1.5
Total	363	151	735	40	83	1372	100
%	26.5	11.0	53.6	2.9	6.0	100	

Note: d-que= display question, g-que= genuine question, req BM=request for Malay, req Eng= request for English, text trans= text translation.