



UNIVERSITI PUTRA MALAYSIA

**ADJUNCT LANGUAGE INSTRUCTION FOR ENGLISH AS A SECOND
LANGUAGE ENGINEERING STUDENTS IN WRITING OF PHYSICS
LABORATORY REPORTS**

MEGAWATI BINTI OMAR.

FBMK 2005 7



**ADJUNCT LANGUAGE INSTRUCTION FOR ENGLISH AS A SECOND
LANGUAGE ENGINEERING STUDENTS IN THE WRITING OF PHYSICS
LABORATORY REPORTS**

MEGAWATI OMAR



**Thesis Submitted to the School of Graduate Studies, Universiti Putra
Malaysia, in Fulfilment of the Requirements for the Degree of Doctor of
Philosophy**

September 2005



DEDICATION

This thesis is dedicated to Omar Mahari and Dora.



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in
fulfilment of the requirements for the degree of Doctor of Philosophy

**ADJUNCT LANGUAGE INSTRUCTION FOR ENGLISH AS A SECOND
LANGUAGE ENGINEERING STUDENTS IN THE WRITING OF PHYSICS
LABORATORY REPORTS**

By

MEGAWATI OMAR

September 2005

Chairman: Professor Chan Swee Heng, PhD

Faculty: Modern Languages and Communication

This study investigated the extent to which adjunct language instruction (ALI)
was effective and identified the factors that influenced the effectiveness.

In exploring the effectiveness, this study attempted a study on engineering
students in UiTM using customized lab report writing instructional materials.
A needs analysis was conducted and it showed that engineering students
preferred learning report writing to personal essay writing. The students'
preference for learning report writing set the stage for further exploration.
Sixty students were instructed lab report writing in content-based writing

using genre-based materials based on the students' actual Physics lab experiments, called Physics Adjunct Language Instruction (PALI). The results showed that the students' grades of lab report writing improved. Another test was carried out to find whether teaching writing in an ALL approach was able to meet the writing needs of engineering students. This test used Structural Equation Modeling (SEM) as an analytical tool. As SEM requires a sample size of 200 to 300 respondents, another instruction using similar materials, PALI, was carried out on 260 engineering students. The structural model showed that there were two factors that influence the improvement of the students' lab report writing in PALI. The factors were the teaching conduct and the preference for materials.

In summary, the research revealed three main findings. First, the type of writing needed by engineering students in UiTM was report writing. Second, the PALI led to an improvement in the engineering students' lab report writing ($t = -8.01$, $p = .000$). Third, PALI provided two factors or conditions necessary for its success: the way the lab report writing was taught ($\beta = 0.451$) and the preference of materials which are related to the learners' content subject ($\beta = 0.419$). These two necessary conditions contribute 69.9% ($R^2 = .699$) to meeting the success in lab report writing of these engineering students

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

**ADJUNCT LANGUAGE INSTRUCTION UNTUK PELAJAR
KEJURUTERAAN DALAM PENULISAN LAPURAN MAKMAL FIZIK**

oleh

MEGAWATI OMAR

September 2005

Pengerusi: Profesor Chan Swee Heng, PhD

Fakulti: Bahasa Moden dan Komunikasi

Kajian ini bertujuan untuk melihat sejauh mana keberkesanan 'Adjunct Language Instruction' (ALI) dan faktor-faktor yang membawa kepada keberkesanan tersebut dengan menggunakan bahan mengajar penulisan.

Bagi menjelaskan keberkesanan ALI, eksperimen telah dijalankan terhadap pelajar-pelajar semester dua, program kejuruteraan di Universiti Teknologi MARA, Malaysia.

Pertama, analisis keperluan yang dijalankan menunjukkan para pelajar program kejuruteraan ini lebih berminat untuk mempelajari penulisan laporan berbanding penulisan esei. Kedua, kajian dilakukan terhadap keberkesanan dalam pengajaran penulisan laporan makmal. Kajian ini dilihat dengan cara mengajar 60 orang pelajar kejuruteraan penulisan berdasarkan 'content-based'. Pengajaran ini menggunakan bahan penulisan berasas genre seperti yang digunakan oleh pelajar-pelajar di makmal fizik. Bahan mengajar ini dinamakan PALI (Physics Adjunct Language Instruction).

Keputusan menunjukkan tahap pencapaian para pelajar dalam penulisan laporan makmal meningkat. Seterusnya, kajian dibuat untuk mengenal pasti faktor-faktor kepada keberkesanan tersebut. Dalam fasa ini kaedah 'Structural Equation Modeling' (SEM) digunakan sebagai alat analitikal. Memandangkan SEM memerlukan 200 – 300 sampel, maka 260 orang pelajar kejuruteraan telah diajar dalam fasa ini dengan menggunakan bahan-bahan yang sama iaitu PALI.

Kajian ini telah menemui tiga dapatan. Pertama, jenis penulisan yang diperlukan oleh para pelajar program kejuruteraan ialah penulisan laporan. Kedua, penulisan laporan dengan menggunakan kaedah PALI, telah

meningkatkan tahap pencapaian penulisan laporan makmal oleh para pelajar program kejuruteraan ($t = -8.01$; $p = 0.000$). Ketiga, PALI yang digunakan dalam kajian ini menyumbangkan dua faktor atau syarat yang diperlukan untuk keberkesannya. Faktor-faktor tersebut ialah 1) cara yang digunakan untuk mengajar penulisan laporan ($\beta=0.451$), 2) para pelajar lebih suka belajar menggunakan bahan-bahan Bahasa Inggeris yang berkaitan dengan mata pelajaran penting mereka ($\beta=0.419$). Kedua-dua syarat ini telah menyumbang sebanyak 69.99% ($R^2 = 0.699$) untuk memenuhi keperluan penulisan laporan oleh para pelajar program kejuruteraan itu.

ACKNOWLEDGEMENTS

During a slow and arduous evolution of this thesis I have accumulated many debts in which only some I have space to acknowledge here. No words come close to expressing the depth of my gratitude. I thank my three supervisors, Professor Dr. Chan Swee Heng (UPM), Associate Professor Dr. Wong Bee Eng (UPM), and Professor Dr. Mokhtar Abdullah (UKM), who are every student's 'dream' supervisors – responsive, caring, supportive, and reasonable. My gratitude also goes to my son Omar Mahari, daughter Dora, maids Sunarti and Satem for their tolerance and understanding. I do owe two dear friends, Pn. Foziah Shaari and Cik Radhiah Mohd Ghouse, the sounding boards, who saw me through the most two tumultuous years towards the end of the thesis.

Equally, my debt of gratitude goes to:

- Universiti Teknologi MARA, Shah Alam, Malaysia (UiTM).
- Student Normadihana Abdul Majid of Group 2E9, the Faculty of Engineering, (Dec. 1998-May 1999 semester), UiTM.
- Student Fairul Nazmie, the Faculty of Electrical Engineering, UiTM.
- Groups 2E2 and 2E5 students of the Faculty of Engineering (July-November 1999 semester), UiTM.
- Groups 2E2, 2E3 and 2E8 students of the Faculty of Engineering (December 1999-April 2000 semester), UiTM.
- Three hundred and forty one students of the Faculty of Engineering (July - November 2002 semester), UiTM.
- Encik Halim Mohtar, Akademi Pengajian Bahasa, UiTM.
- Encik Mohd Nasir Zakaria, the Faculty of Engineering, UiTM (my 1993 student at Kuantan).
- Cik Norazila, Pusat Sains, UiTM.
- Puan Asiah, Pusat Sains, UiTM.
- Cikgu Sutina Rashid.
- Cikgu Juriah Ahmad.
- Pn. Siti Akmar Abu Samah, Akademi Pengajian Bahasa, UiTM.
- Pn. Juridah Atin, Akademi Pengajian Bahasa, UiTM.
- Encik Imran Danial Krish bin Abdullah , UiTM.
- Pn. Haliza Ghani, Akademi Pengajian Bahasa, UiTM.
- Pn. Usdijadi Raden, Akademi Pengajian Bahasa, UiTM.
- Pn. Zaemah, Akademi Pengajian Bahasa, UiTM.
- Pn. Norbaya Aris, Akademi Pengajian Bahasa UiTM.
- Dr. Faiz, Pusat Bahasa, UiTM.
- Encik Radzi Abd. Manap, Pusat Bahasa, UiTM.
- Encik Malik Jafar, Pusat Bahasa, UiTM,
- Encik Khairul, (Chaq) of ADMACS, Shah Alam.
- Dr. Noreha Husain, Ad-Macs, Shah Alam.
- Dr. Malcom MacDonald, CELT, University of Stirling, Scotland.
- Dr. Sharifah Latifah Syed Abdul Kadir, University Malaya.
- Dr. Roziah Janor, INKA, UiTM.

- Prof. Dr. Hazman Shah, the Faculty of Public Administration, UiTM.
- Assoc. Prof. Dr. Rasimah Aripin, the Human Resources Department, UiTM.
- Dr. Richard Holmes, the Faculty of Education, UiTM, Section 17, Shah Alam.
- Puan Saidah, the Computer Department, UiTM.
- Cik Midiyana Mohamad, Akademi Pengajian Bahasa, UiTM.
- Pn. Siti Nordinar, Pusat Bahasa UiTM.
- Pn. Marina Ismail, the Coordinator (Administration) of Akademi Pengajian Bahasa, UiTM.
- Encik Mohamad Shahr bin Sudar, Akademi Pengajian Bahasa, UiTM.
- Encik Shahizan bin Said, Akademi Pengajian Bahasa, UiTM.

Megawati Omar

November 2005
Shah Alam, Malaysia



TABLE OF CONTENTS

	Page
DEDICATION	i
ABSTRACT	ii
ABSTRAK	iii
ACKNOWLEDGEMENTS	iv
APPROVAL	v
DECLARATION	vi
LIST OF TABLES	vii
LIST OF FIGURES	viii
LIST OF ABBREVIATIONS	ix
CHARTS OF THE THESIS ORGANIZATION	x

CHAPTER

I	INTRODUCTION	1
	1.1 Background to the study	1
	1.2 Problem statement	8
	1.3 Purpose of the study	12
	1.4 Objectives of the study	13
	1.5 Research questions	13
	1.6 Significance of the study	14
	1.7 Scope of the study	16
	1.8 Definition of terms	17
2	THEORETICAL AND PRACTICAL ISSUES	18
	2.1 Introduction	18
	2.2 Theoretical issues	18
	2.2.1 Types of learning models in content-based instruction (CBI)	19
	2.2.2 The theory of register	24
	2.3 Practical issues	29
	2.3.1 Approaches to writing for engineering students	29
	2.3.2 The need for specific writing skills by technical students	36
	2.3.3 The need for writing skills by engineers	39
	2.3.4 Factors affecting the second language writing ability of engineering students	44
	2.4 Conclusion	52
3	LITERATURE REVIEW	54
	3.1 Introduction	54
	3.2 Writing	55
	3.2.1 Definition of writing	57
	3.2.2 Main types of writing	58
	3.2.2.1 Personal and expository writing	58
	3.2.2.2 Technical writing	60

3.2.3	Instructional models of writing	64
3.2.4	Instructional materials for lab report writing	73
3.3	English for specific purposes (ESP)	78
3.3.1	Definition of ESP	78
3.3.2	Classification of ESP	80
3.3.3	Lab report writing	81
3.3.4	The lab report genre	90
3.4	Content-based instruction (CBI)	92
3.4.1	Definition of CBI	94
3.4.2	Possible contributing factors to the effectiveness of CBI	97
3.5	ESP and CBI	103
3.6	Conclusion	108
4	METHODOLOGY	112
4.1	Introduction	112
4.1.1	Needs survey	112
4.1.2	Pretest and posttest	113
4.1.3	SEM test	113
4.2	Procedure	114
4.2.1	Needs survey	115
4.2.2	Selection of instructional materials	115
4.2.3	Preparation of the Physics adjunct language instruction (PALI) instructional materials	116
4.2.4	Participants	118
4.2.4.1	The consent of the participants	120
4.2.5	Pretests	121
4.2.6	Instruction	122
4.2.6.1	Instruction of lab report writing in the pretest and posttest: Group A	123
4.2.6.2	Instruction of personal essay writing in the pretest and posttest: Groups A and B	127
4.2.7	Posttests	129
4.2.8	SEM test	131
4.2.8.1	Step 1 – Hypothesizing a model	134
4.2.8.2	Step 2 – Data collection for SEM	135
4.2.8.3	Step 3 – Confirmatory factor analysis	136
4.2.8.4	Step 4 – Identifying the model	136
4.2.8.5	Step 5 – Modifying the model	136
4.3	Sampling design	137
4.3.1	Assessment of the level of the English language proficiency of the participants	137
4.4	Methodological assumptions of the study	139
4.5	Precaution	140
4.6	Conclusion	140
5	RESULTS AND DISCUSSION	142
5.1	Introduction	142

5.2	Results	142
5.2.1	Research question 1 – What are the writing needs of the UiTM engineering ESL students and to what extent are the current writing tasks relevant to them?	142
5.2.2	Research question 2 – What are the salient features that characterize the preparation and use of the instructional materials for Physics Adjunct Language Instruction (PALI)?	148
5.2.3	Research question 3 – Is there any significant difference between the pretest and posttest writing scores in:	170
5.2.3.1	Lab report writing tasks	170
5.2.3.2	Comparison of lab report writing between Group A and Group B	176
5.2.3.3	Overall lab report writing performance: analyses based on descriptive statistics	178
5.2.3.4	Summary of improvement in lab report writing skills after PALI	185
5.2.4	Research question 4 – What are the necessary conditions for PALI success as shown through SEM modeling?	194
5.2.4.1	Hypothesizing of the model	194
5.2.4.2	Data for SEM	196
5.2.4.3	Confirmatory factor analysis (CFA)	199
5.2.4.4	Identifying the model	202
5.2.4.5	Modifying the model	203
5.2.4.6	Necessary condition	215
	a) Necessary condition 1 – Teaching conduct	215
	b) Necessary condition 2 – Preference for materials	219
	c) Students' language proficiency	222
5.2.4.7	Goodness of fit	226
5.3	Theorized relationship between the necessary conditions and the CBI factors	228
5.4	Conclusion	232
6	CONCLUSION AND RECOMMENDATIONS	234
6.1	Introduction	234
6.2	Summary	234
6.3	Recommendations	238
6.4	Conclusion	247
6.5	Limitation of findings	250
6.6	Directions for future research	252
	REFERENCES	256

REFERENCES	256
APPENDICES	283
BIODATA OF THE AUTHOR	421



LIST OF TABLES

Table		Page
2.1	The Flexibility of CBI Models	26
2.2	The subjects of engineering students requiring written reports	31
3.1	Features of lab reports	83
3.2	Distinguishing features of CBI models	98
3.3	Possible contributing factors to the effectiveness of CBI approaches	99
4.1	Physics lab report instruction schedule for Group A	124
4.2	The process of lab report writing in PALI	127
4.3	Personal essay instruction schedule for Groups A and B	128
4.4	Grading bands and criteria	130
5.1	Description of Physics Adjunct Language Instruction (PALI) materials	157
5.2	Means, t, p values and component scores of lab reports at pretest and posttest by group	171
5.3	Difference of means standard deviations (SD) of the lab report writing scores of Group A and Group B (paired sample means – pretest and posttest)	172
5.4	Lab report writing performance of Group A and Group B	179
5.5	Means, t, p values and component scores of personal essays at pretest and posttest by group	181
5.6	Difference of means and standard deviations (SD) of the personal essay writing scores of Group A and Group B (paired sample means – pretest and posttest)	182
5.7	Personal essay writing performance of Group A and Group B	184
5.8	Incorrect titles in the pretest lab reports	189

5.9	Necessary vocabulary that contribute to good lab reports	192
5.10	Reliability of the seventeen hypothesized indicator variables	198
5.11	Latent variables, indicator variables and details of the indicator variables of the hypothesized Model	199
5.12	Confirmatory Factor Analysis results	201
5.13	The initial factors and their indicator variables	202
5.14	Necessary conditions for PALI and their descriptions	208
5.15	Latent variables (necessary conditions), indicator variables, and descriptions of the indicator variables	209
5.16	Standardized regression weights of Y factor, necessary conditions and indicator variables	212
5.17	Standardized regression weights of latent variables, indicator variables and the details of indicator variables	214
5.18	Indicator variables and their overall coefficient of determination (R^2) in meeting lab report writing needs of engineering students in PALI	224
5.19	Summary of overall goodness of fit (GFI)	227
5.20	Standardized residual covariance	228

LIST OF FIGURES

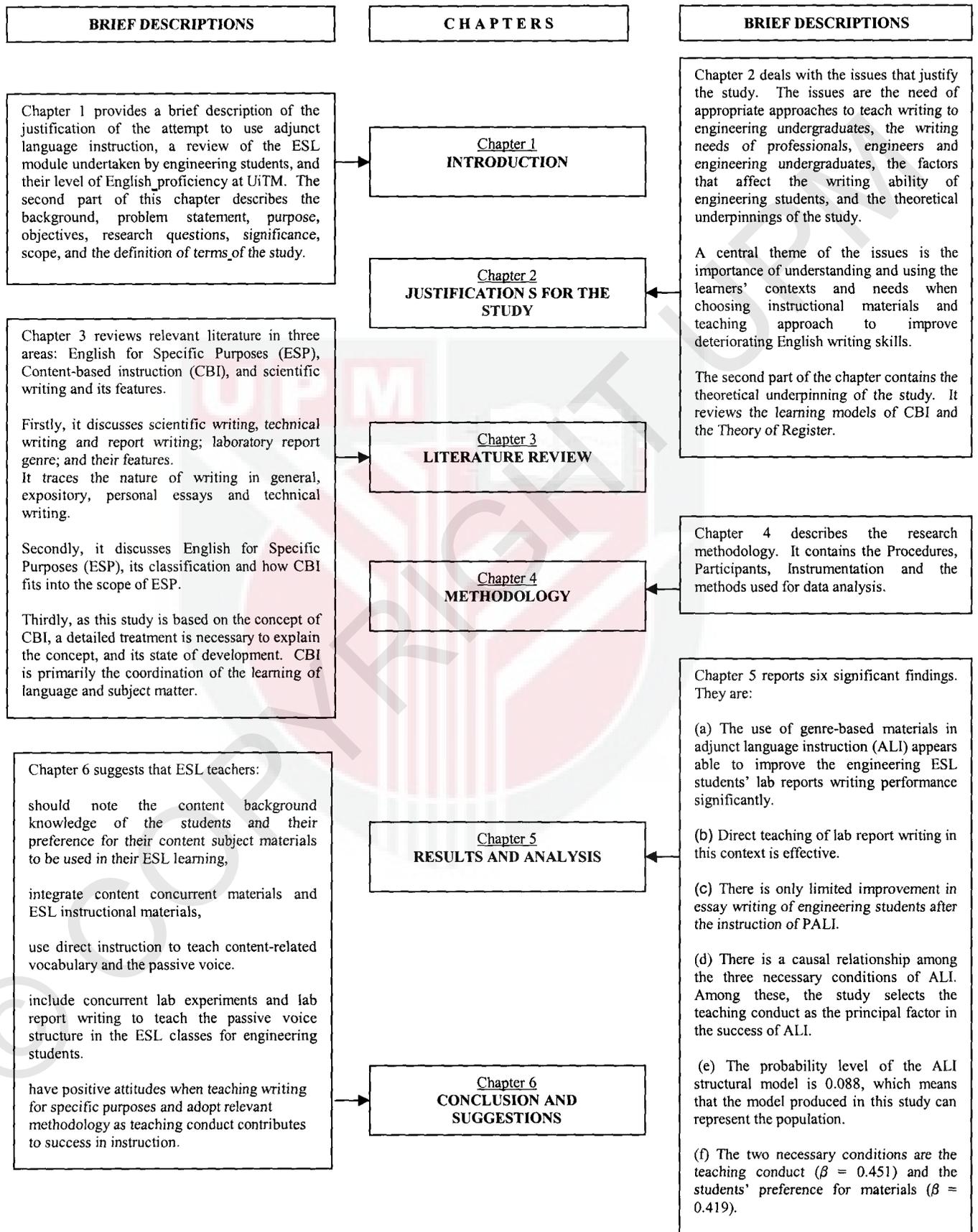
Figure		Page
1.1	Sample of badly written essay by a UiTM engineering student	9
1.2	Sample of badly written lab report by a UiTM engineering student	10
3.1	Typical structure of a LR	86
3.2	Communication flow in science	91
3.3	CBI in relation to ESP	106
3.4	CBI on a ESP continuum	107
4.1	The transformation of the structure of lab reports into a lab report process chart	117
4.2	The transformation of the lab report structure into a lab report writing process	118
5.1	Respondents' opinion (%) on the importance of report writing skills (N=232)	144
5.2	Respondents' opinion (%) on the importance of learning to write short stories and essays (N=232)	145
5.3	Respondents' opinion (%) on learning ESL using Physics materials (N=232)	146
5.4	Percentage of Physics reference books of the respondents in English	147
5.5	Salient features and steps of the production and use of PALI	149
5.6	The retention of vocabulary by the respondents	163
5.7	Lesson plan 1	167
5.8	Lesson plan 2	168
5.9	Lesson plan 3	169
5.10	Example of pretest lab report	173

5.11	Example of posttest lab report	174
5.12	Group A – Lab report pretest and posttest scores	177
5.13	Group B – Lab report pretest and posttest score	178
5.14	Hypothesized model of PALI	195
5.15	A structural model of necessary conditions that meet the lab report writing needs of engineering students in adjunct language instruction	210
5.16	Factors of CBI thriving in the necessary conditions of ALI	231
6.1	Steps in direct instruction	243
6.2	Activities in PALI	244

LIST OF ABBREVIATIONS

ALI	Adjunct Language Instruction
CBI	Content Based Instruction
ESL	English as a Second Language
ESP	English for Specific Purposes
LR	Lab Report
SEM	Structural Equation Modelling
UiTM	University Teknologi MARA, Malaysia
PALI	Physics Adjunct Language Instruction

The Organization of the Thesis



CHAPTER 1

INTRODUCTION

This chapter describes the background, justification, problem statement, purpose, objectives, research questions, significance, scope, and definition of terms of the study.

1.1 Background of the Study

The poor writing performance of engineering students at UiTM has remained a major cause for concern. The non-content writing instruction elicits general complaints from most ESL teachers teaching writing in the Faculty of Engineering, of whom the present writer is one of them, that the writing performance is generally unsatisfactory. In fact, this study began with the observation of three problems during the writer's ten years of teaching non-content based writing to engineering students of the university. The first was the students' continuous production of unsatisfactory short essays. The second was the students' anxiety about the language of the reports that they wrote in English to meet the requirement of their content subjects. The third was the persistent errors generated when they used the passive voice in the writing. Some information was also gathered to throw light on the language proficiency of engineering students in UiTM. Engineering students of UiTM who studied in December 1999-April 2000 reported that they faced a lot of difficulties when they had to write their final year projects because of poor

writing skills (Language Centre, UiTM). They claimed that this particular inability severely affected their overall academic results. In addition, comments gathered from the English language teachers at the Language Centre, UiTM, pointed mainly towards the students' inability to speak and write. They commented that students severely lacked vocabulary knowledge that is expected from university students and this may be attributed to a lack of reading habit, exposure to English language, and inappropriate teaching methods. To overcome these problems, the students continuously sought help from their English language teachers to edit their reports before submitting them to their science and engineering content instructors.

The problems in classrooms and the information from the ESL instructors in UiTM signaled an important direction in which ESL teaching should take. It led to the present writer's inference that the students' continuous production of unsatisfactory essays and reports might be related to, though not directly caused by, the inappropriate instructional approaches and irrelevant instructional materials. In particular, the writer assumed that inappropriate instructional approaches and irrelevant materials led to the students' dislike of writing, which in turn led to the students' unsatisfactory writing. Mohan (1986) claims that an educational approach that separates language learning and subject matter is inadequate to fulfill the needs of learners. For example, the present writer had seen in classrooms that the learners concerned in this study failed to write clearly to express their knowledge in written academic projects. This could be due to language learning being separated from the content areas. It was also believed that the materials